# SPATIO-TEMPORAL ASPECTS OF AGRICULTURE IN BURDWAN DISTRICT.

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# C O N T E N T S

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## INTRODUCTION

Agriculture is as old as human civilization and yet it is always in the process of transformation. But in spite of its dynamism many vestiges of the old forms still linger. The growth of industrial-commercial agriculture as in the modern societies has not completely obliterated the traditional ways of life. Such agricultural sophistication is not, however, uniform in our country. Spatial variations exist with the variations in science and technology. As the farmland areas of India have almost reached the saturation point, there is little scope for any substantial increase of her agricultural production through extension of cultivation and through increase of her per-unit productivity rate through intensive cultivation.

From early days till now Burdwan has been known to be the granary of West Bengal. There is every possibility and scope to produce a large amount of crop shares in West Bengal. Though the district enjoys variegated topography i.e. undulated land in the western part and flat land in the eastern, the district has been 'an important rice granary' since early days. Historically this district occupies a remarkable position in our country, where Burdwan Raj dynasty dominated the scene for decades. Though fallen from its pristine glory, the district is still one of the richest in West Bengal as one of the principal sources of food supply for the state.

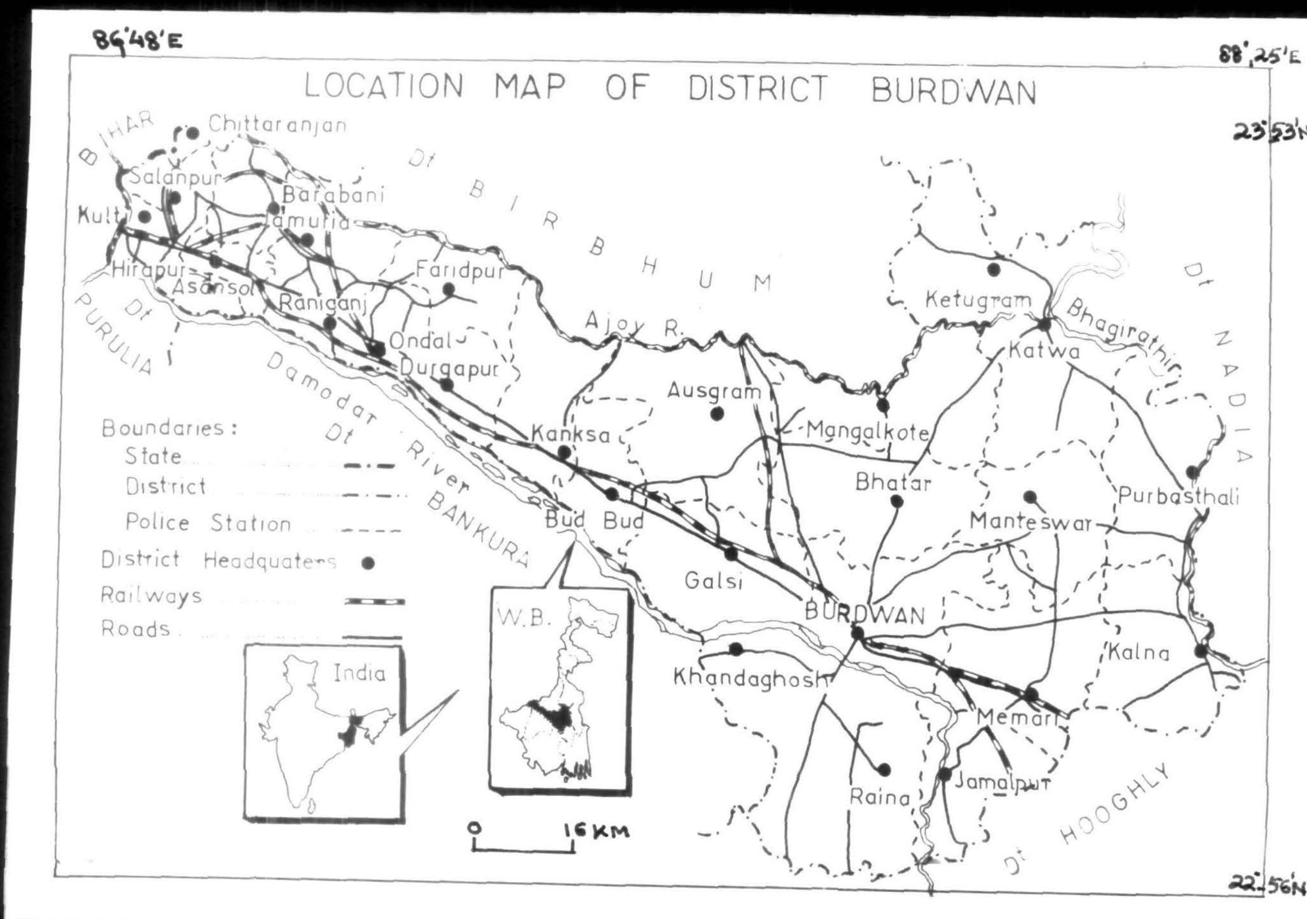

86°48'E
88°25'E
23°53'N
22°56'N
LOCATION MAP OF DISTRICT BURDWAN
BIHAR
Chittaranjan
Salanpur
Barabani
Jamuria
Kulti
Hirapur
Asansol
Raniganj
Faridpur
Ondal
Durgapur
Dt BIRBHUM
Ajoy R.
Ketugram
Katwa
Bhagirathi
Dt NADIA
Dt PURULIA
Damodar River
Dt BANKURA
Ausgram
Mangalkote
Kanksa
Bhatar
Purbasthali
Manteswar
Bud Bud
Galsi
BURDWAN
Kalna
Khandaghosh
Memari
Jamalpur
Raina
Dt HOOGHLY
Boundaries:
State
District
Police Station
District Headquaters
Railways
Roads
India
W.B.
0 16 KM

Fig. No. 1

The district of Burdwan, one of the western district of West Bengal, is situated between 22°56' N and 23°53' North latitude and between 86°48' E and 88°25' East longitude. In the map of India it is located at the eastern part. The district is bounded on the north by Santhal Parganas of Bihar; Birbhum and Murshidabad district on the east; by Nadia district, on the south by Hooghly, Midnapur and Bankura district and on the West by Purulia district. (Fig No. 1)

The total area of the district is 7028 sq. km. of which rural area is 6715 sq. km. and urban area is 313 sq. km. The total population of Burdwan was 3,916,174 among which 2,076,210 were males and 1,8~~2~~39,964 were females as per 1971 census. The total number of workers of Burdwan was 1,090,809 of which agricultural workers was 599,478 i.e. 27.40%, among which cultivators and agricultural labourers were respectively 24.23% and 30.58% according to 1971 census.

According to 1951 census, there were 24 police stations and according to 1971, there were 27 police stations. The additional three police stations Chittaranjan, Durgapur and Budbud were under Salanpur, Faridpur-Andal and Ausgram-Galsi police stations respectively. The following study has been made on the basis of the map of 27-police stations and only some on 24-police stations. The relevant data on soil, agricultural acreage-production etc. are collected on the basis of 24-police stations.

The object of this study is to focus attention on the influence of the topography, climates and unequal socio-economic conditions on the agricultural activities in the district of Burdwan. Since Independence, there has been considerable progress in agricultural production but the productivity per hectare has not shown any appreciable increase, as was expected. The district, however, occupies a remarkable position in agricultural production in India. Considerable opportunities exist for augmenting crop production in the district of Burdwan.

It is the district of Burdwan alone which was selected as an IADP (Intensive Agricultural District Programme) area in West Bengal during 1960-61, due to the favourable condition of topography (eastern part), drainage net work, soil, climate and additionally greater agricultural production than that of other districts. As Burdwan was the richest food producer in West Bengal, where all the conditions of new package programme were present, the planners decided to initiate the Green Revolution in the district. During 1966-67, the new approach was initiated as strategy of agricultural development. Undoubtedly, it may be said that with undulated land at the western part and vast plain fertile land at the eastern part, Burdwan has been the main source of the food supply for the state of West Bengal from very early days.

So, importance was given to the growth of more production in Burdwan in terms of agriculture and hence several modern techniques and other necessary arrangements have been adopted. Therefore, it is an interesting study to analyse the spatial variation of acreage and production of crops in the district after Independence upto the present period. The question arises whether the trend-line of agricultural development in the district is increasing or decreasing or stagnant ?

The name of Burdwan is suggestive in that it comes from the original word 'Vardhamana', which means 'increasing or prospering'. This is justified from agricultural point of view. Burdwan had so highly flourished agriculturally that there was no other district in India which could stand comparison with it. The agricultural operations adopted in it were considerably dependent upon nature. During ancient times the whole of the district was under Mughal emperors. In the mediaeval period, the Zamindar was all in all, i.e. the landed property was under his control and he collected revenue from the public. During zamindari era the agricultural situation in Burdwan declined. The main causes of agricultural decline were natural calamities (flood, drought, cyclone, earthquake) and socio-economic condition of our country. In the middle of the eighteenth century Burdwan was under East India

Company and towards the end of this century Lord Cornwalis created the Zamindari system. In the past cultivation was made widely over the eastern part and in patches over the central part because the western part was covered by forests. The extension of cultivation horizontally was made throughout the district from the later part of nineteenth century. There was no regular system of rotation of crops in the period preceding twentieth century. In the western and west central part the people were more attracted towards mining, factories than cultivated fields. After Independence, in the year 1950, the Fifth Plan programme was launched. During the first plan (1950-51), the highest priority was given to increase of agricultural production both horizontally and vertically for which there was very great scope in the district.

Physiography is the basic concept, its role in the veriegation of areal agricultural complex is primary and undeniable. The district of Burdwan is one of the largest districts of West Bengal with an elongated shape, "club or hammer shaped" from the rivef Bhagirathi in the eastern border to the border of the state of Bihar in the west. The relief of the district merges in the west with the periphery of the Archaean complex of the Chhotonagpur plateau

and the Gondwana series in the form of a through extending from the coalfield region of Ranigunj to the Asansol-Barakar coalfield. The rest of the area is occupied by the deltaic formations drained by the rivers Damodar, Ajay and a number of other short non-perennial streams. The Ajay and the Damodar form for a considerable part the northern and southern boundary of the district respectively. The relief is characterised by a slow gradient from the northwest to the south-east, which is apparent from the direction of flow of the rivers with a drainage network. Topographically from west to east the district may be sub-divided into plateau fringe area, zone of degradation and zone of aggradation. The natural vegetation also depends upon topographical characteristics, climatic and soil conditions of the area. The important natural vegetations are Sāl, Babla, Banyan, Nim, Palas etc.

Climate is the principal aspect of the physical environment affecting agriculture. The soil is the product of present and past climates and the vegetation has flourished on the soil. The uncertainties of weather have significant impacts on agricultural strategy and it is a constant source of fluctuation in production and quality of crops. From agricultural point of view, rainfall is the most important climatic factor and other factors are temperature, sun-shine,

wind etc. The climatic conditions differ in the district of Burdwan from west to east. The production of crop depends primarily on rainfall during monsoonal period (June-September) and in winter and summer the production of crop depends directly on the water of canal, deep-tubewell, well, and indirectly on rainfall. It is quite natural that late arrival and early retreat of the monsoon seriously hampers the growth of paddy. The temperature of the western part of the district is of extreme nature, i.e. very hot during summer and very cold during winter season. The variation of total annual rainfall of different parts of the district is not very remarkable, rather spatial variation of monthly rainfall is one of the principal factors for agricultural variability in the district. It may be said that dry area of the western part and wet area of the eastern part of the district have different potentiality of agricultural production.

Soil plays a very significant role in the development of economic condition of a region. One soil can be distinguished from another according to the variations in the nature of horizons in soil profiles. Fertility of soil seems to exert significant influence on the spatial distribution of cultivated land, spatial differences in the intensity of agricultural activities and also production of crops in the district of

Burdwan. Soil characteristics in a place result from the combined influence of climate and living matter, acting upon the parent rock material, as conditioned by relief over periods of time, including the effects of cultural environments and man's use of the soil. The western portion consists of lateritic and laterite soils and red soils and the eastern portion consists of Vindhya alluvium and gangetic alluvium. The alluvial area is very fertile, suitable for production of crops which consists of old alluvium and new deltaic alluvium. For the determination of soil productivity, it is necessary to analyse the physical and chemical properties of soil. Soil erosion by wind and water takes place throughout the district, though it is greater over the western part due to undulated topography. Due to inadequacy of surface water, sub-soil water are of considerable importance to agriculture. The depth to reach the sub-soil water spatially varies, it gradually decreases from west to east.

The total cropped area in the district increases with the increase in the area sown more than once and decreases in the fallow area. During the first two plan periods though irrigational facilities increased more or less, the relative positions of agricultural land use and production did not undergo any substantial change. In the eastern part most of

the lands are occupied by agricultural fields, about 70 per cent, whereas in the western part large portions of lands are occupied by factory and mining areas. Area under agricultural crops does not remain constant for all the year. In years with unfavourable weather conditions the cropped area decreases. The irrigated areas under kharif crops are more than those under Rabi crops. Size of holding varies over space and time in the district. Fragmentation of land is more pronounced in the western part than in the other parts of the district. Fragmentation of holding hinders agricultural progress and it interferes with the full utilization of land. The cultivation of double or triple crops is limited within a few police stations due to lack of water.

Due to the diversity in physiography, soil, climate, economic and social setup, the district of Burdwan produces a large number of crops. Cropping pattern means both the time and space sequence of crops. The cropping pattern changes with the improvement in technology and economic factors. Paddy is the principal crop in Burdwan. Due to the greatest importance of paddy among the crops in the district, secondary crops, i.e. wheat, potato, pulses, jute, sugarcane, oilseeds etc. occupy a proportionately lower percentage of the net sown area. Monthly rainfall is unevenly distributed in time

and space, being excessive in one part of the district and insufficient in the other, which hampers the pattern of crop. There is need for wise planning of our cropping pattern with due regard to the climatic limitations. The maximum area of land is used for the cultivation of Aman paddy. The high yielding variety paddy gives better yields as compared to local varieties. The acreage and productivity of HYV paddy is better in Rabi than in Kharif season. The area under double cropping is low in the western part, and high in the eastern part of the district though there exists to some extent spatial variations. Among the secondary crops, only pulses and oil-seeds are grown in the western part of the district because of scarcity of water. With irrigation facilities, multiple cropping can be adopted all over the district, specially the dry crops (pulses, Ragi, Jowar, Bajra, vegetables etc.) at the western part.

Revolution, as applied to agriculture, means in effect, a transformation from old and lower level of production to new and higher level. In short, 'Green Revolution' brings about a large increase in agricultural production —— and such production takes place in a short space and time by means of high yielding varieties of seeds and new methods of cultivation. The core of the new technology consists of new-researched HYV-seeds with optimum inputs, such as irrigation,

fertilizer and pesticides under new agricultural practices, i.e. use of scientific implements and techniques. Although the change in agricultural production has taken place during last two decades in the district, yet it varies spatially. Such spatial variation of agricultural production in its turn is also directly or indirectly related to physiography, inadequate inputs (irrigation, fertilizer, pesticide, scientific implements, credit etc.) and socio-economic condition of the farmers. These HYV seed require regulated application of water with good drainage facilities at the same time. Unfortunately, the timing for irrigation, which is the essence for optimum yield, is a vexed problem in this district because of vagaries of weather. A major part of the district still follows the traditional pattern of agricultural practices. So it is necessary to train and guide the farmers along the right line by district agricultural department.

It is possible to provide full picture of the agricultural geography of Burdwan by collecting information, as available in statistical form, from other sources like the reports of administrators, agricultural officers, soil survey office, meteorological office, and personal investigation in different fields-data information with technical observations that may be helpful in planning for agricultural development of the district. Different types of methodology has been applied

in the following chapters to illustrate and express the agricultural condition of the district.

The first chapter deals with the historical aspect of the development of agriculture in the district. The second chapter deals with the physiography and its relationship with agriculture in the district. The third chapter is about the climatic and agricultural instability in the district and the fourth chapter is about soils and their characteristics and influence on agriculture. The fifth, sixth and seventh deal with changes in land utilisation and trends in agricultural production in the district, cropping pattern in Burdwan and impact of Green Revolution on agriculture in the district of Burdwan.

# CHAPTER - I

## HISTORICAL ASPECTS OF THE DEVELOPMENT OF AGRICULTURE IN THE DISTRICT OF BURDWAN

The name of Burdwan comes from the original word "Vardhamana",[1] which means "increasing or prospering". From the agricultural point of view the nomenclature is more or less justified from early days till now. The district occupies a unique position, because it is a place of intercourse and mingling between Aryans and tribes. Besides, it is an area lying between hilly upland and plain land.

Agricultural Conditions during the past : Agriculture has been a national wealth from the early period. During ancient times Burdwan was rich in agricultural production. Agricultural operations during the ancient times were considerably dependent upon nature. During Vedic period, India showed rapid progress in agricultural production. In fourteenth century, at first Kanksa and then gradually other areas of the district were conquered by the Mughal emperors. The method of cultivation in the ancient period was different from that of the mediaval period. In the mediaval period, the different classes of intermediaries, chief farmers and jagirdars were grouped into one class designated as 'Zamindars'. The slow progress of cultivation was

characteristic of the sixteenth century. The Pathan Sultans provided permanent residence to Muslim soldiers and other state employees by donating landed property to them. This system is known as "Ayma" and those enjoying it are called "Aymadar".[2] There was a large number of "Aymadar" in the district. After 1570, the whole of Burdwan with the South Damodar came under the Mughals. In the year 1583, the Mughal commander, Todarmal had a measurement made of the area of the whole district and the quantity of crops produced. According to the variation of production, the land of the district was classified into high class, middle class and low class land. One third of the total production was taken as a Government revenue. This classification of Todarmal was modified by extensive zamindary system and "Chakla system of Murshid Kuli Khan".[3] But principally Burdwan was under 'Sarkar Sarifabad', 'Selimabad' and 'Mandaran'. "The western part of the district was under 'Mandaran', the south eastern part was under 'Selimabad' and the rest was under 'Sarifabad'".[4] The seventeenth century was the period in which satisfactory production of agriculture was achieved. At the later part of the seventeenth century the Burdwan Raj dynasty was established. It was founded by Babu Ray and his successors were Krishnaram Ray, Jagatram Ray, Kirtichandra Ray, Chitrasen Ray, Tilakchand Ray, Tejchand Ray, Pratapchand Ray, Mahatabchand Ray, Aftab

Chand Ray and Bijoy Chand Ray. The agricultural growth had been relatively slow from 1694 to Plassey (1857). In the early eighteenth century four-fifths of the people were dependent on agriculture. In the mid-eighteenth century Burdwan was attacked by the Marathas. Cultivation stopped as a result of this invasion. Under the Maratha rule land was cultivated by the peasant proprietors called mirasdars or hereditary owners of their fields. "So far with regard to the zamindars, with regard to the Ryotos or cultivators, Mr. Shore is equally emphatic.

"In every district throughout Bengal, where the licence of exaction has not superseded all rule, the rents of the land are regulated by known rates called Nirik, and in some districts each village has its own. These rates are formed, with respect of the produce of the land, at so much per bigha (a third of an acre); some soil produces two crops in a year of different species, some three".[5]

During early period, cultivation of paddy and sugarcane was "much better"[6] due to utilisation of green manure, oilcake and due to different systems of sugarcane cultivation, i.e. "hole and furrow system".[7]

In the mediaeval period, the Zamindar was all in all; he helped the tenats by improving irrigation dams, bunds, roads and supplying seeds, cattle and instituting hats,bazars to open up the rural areas to civilisation. The per capita land was more than one acre in Bengal. Gradually, the population increased more in proportion to the area available for cultivation. The agricultural prices were very low. There is no dispute among economic historians, that in the eighteenth century Bengal was a rich and populous country. During 1760, prosperous Burdwan was under the East India Company. Just three decades later William Fullarton described, "In former times the Bengal countries were the granary of nations, and the repository of wealth, commerce and manufacture in the East.... But such has been the restless energy of our misgovernment that within the short space of twenty years many parts of these countries have been reduced to the appearance of a desert. The fields are no longer cultivated; extensive tracts are already overgrown with thickets; the husbandman is plundered; the manufacturer oppressed, famine has been repeatedly endured and depopulation has ensured".[8] The surplus agricultural yield was not invested in the country for economic improvement but it was invested elsewhere for the beneficiaries of "British aristocracy, moneyocracy and milliocracy".[9] There was a great famine in

the district since 1770. In 1780, the condition of Burdwan Raj was very pitiable. It may be stated that several disintegrating factors were inherent in the decline of agricultural situation. (i) There were internal conflicts between Jagirdars and Taluqdars. (ii) A large amount of revenue was taken from peasants for land lords' luxurious mode of living. (iii) There were famines due to natural calamity, transport difficulties and outward migration of labourers to the prosperous towns. (iv) There was distress transfer of land by agriculturists due to the influence of urban moneyed classes.

The characteristic features of semifeudal economy created by the British were transformation of the old peasant proprietors into various types of tenants by increasing the rate of rents, introduction of sharecropping, use of forced labour, primitive division of labour and out dated technique of cultivation, production only for household consumption, and use of water for irrigation from artificial sources. Moreover the land tax levied by British Government was heavy and fluctuating. The people of the district began to pay the actual land tax from the British period.

After some time Burdwan Zamindari which was in a sad plight was saved by the "Pattani system". The zamindar created "Darpattani and Sepattani",[10] under him for better

realisation of land revenue. This system applied legally from the year 1819. East India company described that Burdwan was the most productive district of Bengal. In 1815, the same area was referred to by Hamilton in the following words : "That this district continues in a progressive state of improvement is evident from the number of new villages erected, and the increasing number of brick buildings both for religious and domestic purposes, nor is there any other portion of territory in Hindusthan that can compare with it for productive agricultural value in proportion to its size. In this respect Burdwan may claim first rank, the second may be assigned to the province of Tanjore in the Southern carnatic and no less than seven-eighths of the land in Burdwan was then under cultivation".[11] On the British accession, Burdwan was found to be the richest tract of Bengal and the most settled and oldest cultivated district. But after a few years, the people of Burdwan were affected by famine and they could not have supply of adequate food for themselves.

Towards the end of the eighteenth century Lord Cornwalis created the Zamindari system which had permanent settlement as its foundation. There were the Zamindari system in the past and the feudal system existed in the muslim period. Indications are available of the existence

of Aymadar, Jaigirdar and Dihidar in Muslim period. After the fixation of revenue of Todormal, the landlords were known as Zamindars. From Muslim period the peasants were the owners of agricultural field of their village. The passing of the 7th Act in 1779 and 5th Act in 1812 helped the Zamindars to collect land revenues easily. The Zamindars did not fail to take the full advantage of those two acts. Many permanent peasants lost their land and employment. James Mill remarked that Zamindari system was the cause of crimes like, dacoity and snatching. "In the lower provinces of the Bengal presidency the land is held by Zamindars, on payment of an annual sum fixed in perpetuity, the estates being liable to be sold in default of payment under the provisions of Act I of 1845. The only land at the disposal of Government consists of estates which have been thus sold, and purchased on the public account. The rate of land tax can not be given, but is believed to amount on the average to about half the rental".[12] The revenue act of 1859 made by Lord Canning had given security of rent and tenure to the tillers of the soil. Lord Ripon's tenancy act passed in 1885, gave cognizance to the peasants' various rights and thus founded their future economy. But in the meantime arose another problem, that was the emergence of the middle class.

They were the money lenders, they lent money to peasants at high rate of interest at the time of their needs and grab their lands, when they fail to repay the loan. In this way the agricultural fields of the peasants changed hands to non-agricultural people, many among whom were immigrant and unable to work as cultivator. So there flourished the system of share-cropping. There was an influx of the Santhals from adjacent areas due to malaria and poverty. First agricultural farm was started in 1885 by Burdwan Raj and "is situated at Palla on the bank of the Eden Canal".[13] In the later part of nineteenth century the extension of cultivation was made, specially in the Western Part of the district, "which a hundred years ago was an unpeopled wilderness of sāl forest and jungle".[14]

<u>Causes of Decline</u> : During the period eighteenth century and nineteenth century, the crops were much affected by pests and suffered either from excessive or deficient rain-fall.

There were different types of natural calamities like famine, which affected the growth of agricultural production. In 1765, there was famine as well as failure of crops due to deficiency in the annual rainfall. "Burdwan suffered seriously in the great famine of 1770"[15] due to drought. In 1862, the

eastern part of Burdwan was attacked by 'Burdwan fever' and gradually the fever extended towards the west. Burdwan was one of the districts of lower Bengal in which the famine of 1866 due to drought was severely felt. The famine was very acute in Raniganj area. In 1874, there was another famine in the western part due to low production of crops in 1872, untimely rainfall in 1873 and 'Burdwan fever'.

There were other types of natural calamities like flood, cyclone, earthquake, which affected agricultural production adversely. In 1823, 1855, two floods occurred. "The great cyclone of 1874 caused wide spread damage in the district, the vortex passing right over the town of Burdwan itself. The storm was throughout accompanied by heavy rain, and the Banka and Bhagirathi over flowed flooding the surrounding country. The earthquake of 1897 was felt all over the district and the most recent having occurred in August 1909".[16] During 1904, failure of crops took place due to scarcity of rainfall over some portions of the district. In 1909 owing to heavy rains the Banka and other rivers over flowed and flooded large tracts of country and the crops were damaged by their continued immersion. A few serious floods occurred in the Damodar during 1913, 1914, 1917-18 and 1922-23.

Malaria, Cholera and Smallpox in a milder form persisted during the decade 1901-11. The rolling upland of infertile western Burdwan was comparatively free from epidemic and there was some gain in population with no corresponding agricultural gain. Further east lie the low agricultural plains, which are subject to inundation from the Damodar, Ajay rivers and are extremely malarious.

From 1906, Burdwan became a centre of terrorism. The First World War started in 1911. The slow rise in population during the decade 1911-21 was due to various causes. War, floods, famine and diseases like malaria and influenza were the contributing factors. Malaria was also responsible for increasing the death rate. The industrial area of Asansol was one of the exceptions, where coalmines attracted a large number of immigrants. The district suffered from influenza in 1918-19 and also from dropsy, which appeared as an epidemic in 1928-30.

There was great failure of crops during the period from 1925-1934 due to various natural calamities. The general increase in population in the district during the decade 1921-31 was due to employment of Santhals in railway workshops, rice mills, and other industries. The construction

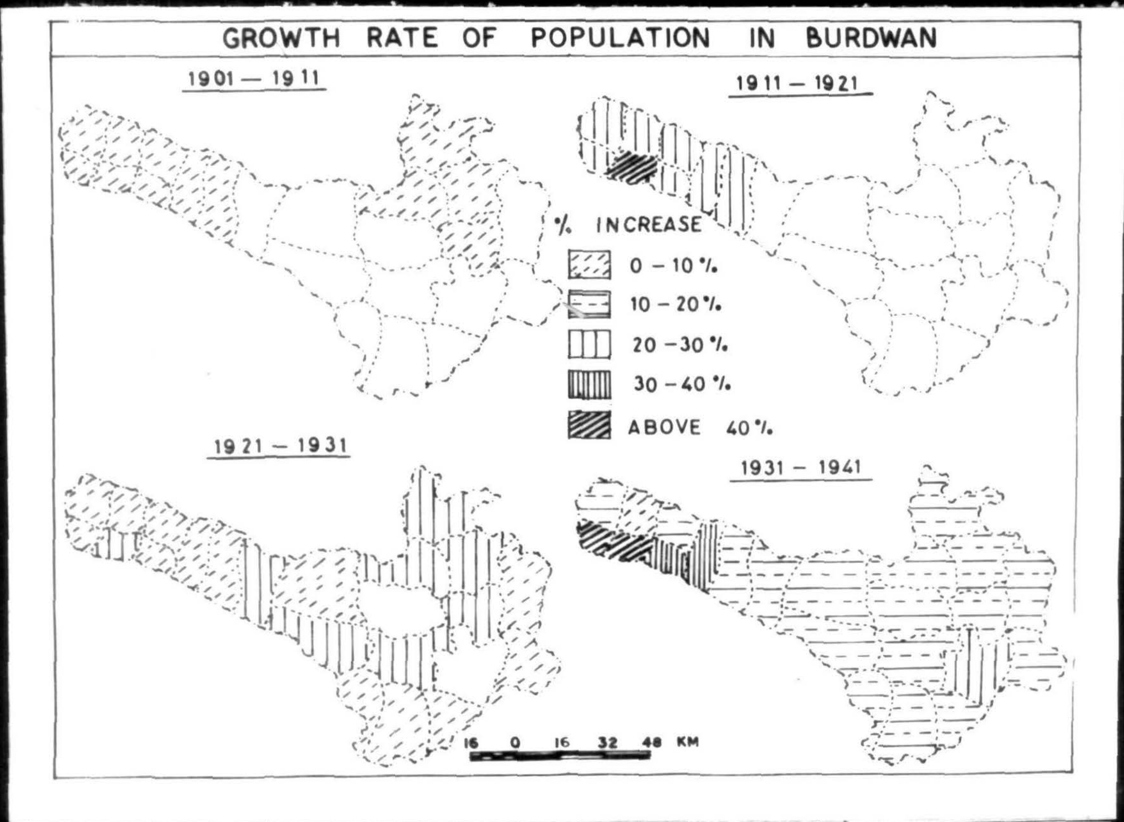

GROWTH RATE OF POPULATION IN BURDWAN
1901 — 1911
1911 — 1921
1921 — 1931
1931 — 1941
% INCREASE
0 – 10 %
10 – 20 %
20 – 30 %
30 – 40 %
ABOVE 40 %
16 0 16 32 48 KM

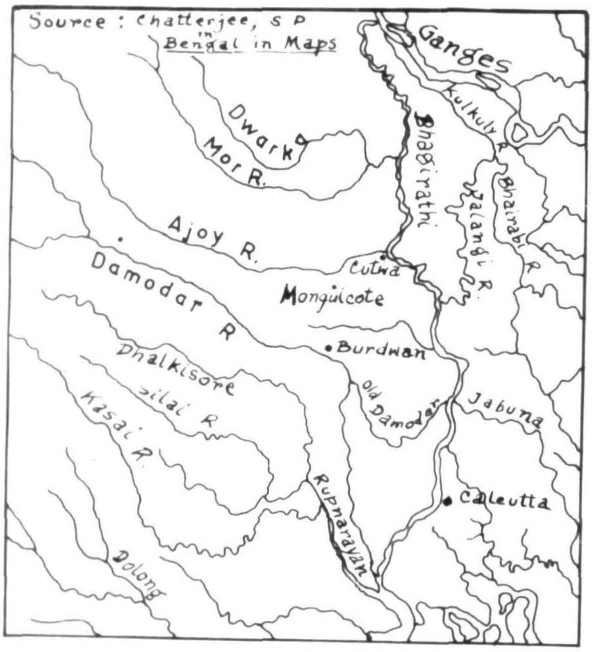
Fig. No. 2

of the Damodar and other irrigation canals also helped the increase of population in the area. On the eve of the Second World War, there had been increasing pressure on agriculture. During the decade 1931-41 there were unprecedented growth of population everywhere. The amount and distribution of rainfall in most of the areas were also unfavourable for agriculture. Floods and drought often damaged the production of crops. After the Second World War in 1939, the economic and political situation became critical. In 1943, there was a great flood in Damodar as a result of which the crops were destroyed and many villages were submerged. The percentages of population for several decades in different parts of the district are shown in the map (Fig. No. 2 ).

Transportation Problem : Transportation was one of the problems till the mid-nineteenth century, since railway lines were first constructed in Bengal only in 1853. In 1912, according to the Director of Agriculture, "The insufficiency of railway culverts are put forward as causes of deterioration".[17]

Condition of drainage, sóil and natural vegetation : "The western portion of the district is a promontory from central India, and consists of barren, rocky and rolling country,

## Rivers Of 18th Century




## Rivers Of 20th Century

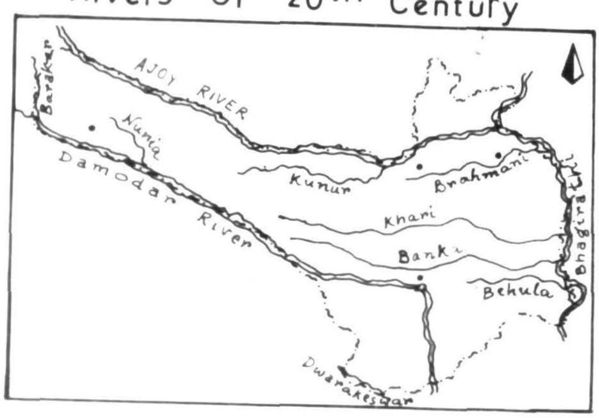



Fig. No. 3

shut in on the west, north, and south by hills. The rest is a delta, the south-eastern edge of which approaches the sea-board, and is of the most recent formation".[18]

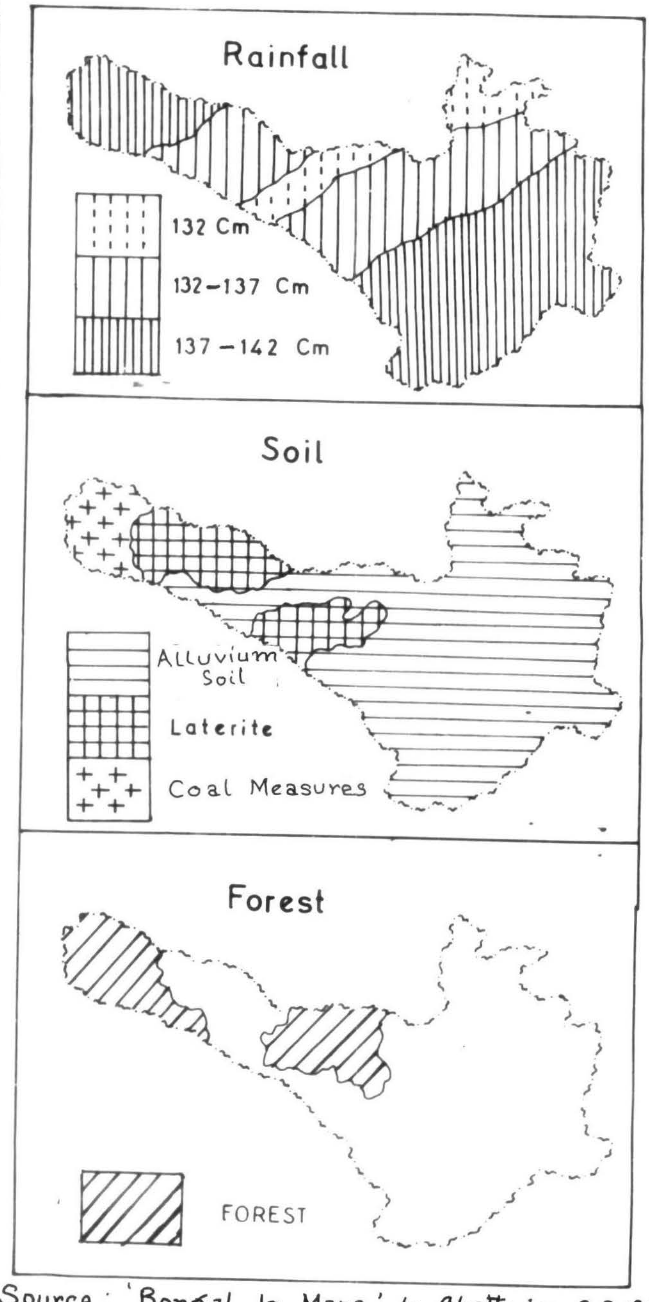
The district was formed by the uncertain and changing courses and siltation of the rivers the Damodar, the Ajay and the Ganges. The agricultural condition was not the same throughout the district. Waterlogging and floods occurred more over the central and eastern portion, due to the presence of rivers and streams throughout the low land. The silt and mud carried by the Damodar and the Ajay made the land fertile. In the beginning of the eighteenth century, the Bhagirathi began to march towards the east (Fig. No. 3 ). Rennel's Map (1779) showed the shifted position of the rivers. In the west of the Bhagirathi "the changes of river course are few. Even the Damodar had almost ceased to flow through its eastern channel before entering the Bhagirathi above Hooghly".[19] All the rivers, the Banka, Behula, Bhagirathi and Kana Damodar had been silted up and their capacity were reduced. For that reason the frequency of flood gradually increased. The waters of the two western rivers the Ajay and the Damodar were not available for agricultural purposes in Bengal. On account of drainage problems of widespread waterlogging, decline of fertility, jungle growth and prevalence of malaria

and agricultural decline, decrease of cultivation and population from the period of mid-nineteenth century took place. In the pre-independence period the condition of drainage, climatic (rainfall) are shown in the relevant maps (Fig. No. 4 ). The eighteenth century Burdwan was "the garden of Bengal", the cultivated area shrank into half during a period of only 40 years, 1891-1931. Such decline of agriculture, which is probably unprecedented in the world, is associated with the decay of the distributary river system of the Ganges, the absence of overflow irrigation, waterlogging and malaria over vast areas, whose prosperity was so graphically described by mediaval travellers".[20]

In the wake of the floods in the past the agricultural condition was improved for several years. On the whole, the average cultivators were fairly prosperous. Another unfavourable factor leading to the decline of agriculture was the decline in population. During 1872-1891 there were 6.5 per cent decrease of population due to 'Burdwan Fever'. The period 1891-1901 was the period of recovery. During the next decade, there were repeated epidemics of cholera and malaria. In the western part of the district, there was one problem and that is, the labourers were more interested to work in factories and collieries than in cultivating fields. From the period 1905-06, the agricultural conditions were less

favourable and gradually declined in the district. The main causes of agricultural decline centred round the ingress and egress of rain and flood water. The rivers were silted up and in many instances entirely dried up. The agricultural condition of Burdwan was deteriorated owing to the loss of fertile alluvial deposits because of the disastrous effect of the shutting out of the Damodar water.

The bed of the Damodar was slowly rising due to greater deposit of silt in comparison to other river beds. At the beginning of the twentieth century, the courses of the Hooghly and the Damodar rivers were changing more frequently. "In most of the cases flooding by itself is not an evil, in fact it is necessary in the interest of public health and productivity of the soil, and also for the conservancy of the river and drainage system of the country".[21] Rise of the flood level necessitates higher and higher embankments. Sudden and concentrated discharge of water through breaches are much more harmful than gradual inundation. From the economic point of view it can be inferred that without siltation agricultural land cannot be fertile. Therefore, the remedial measure ofthe flood problem was the formation of marginal flood embankment, though it was a temporary expedient.




Source : 'Bengal In Maps' by Chatterjee, S.P. 1949

Fig. No. 4

In the past soils were mostly suitable for the growing of paddy and sugarcane. The soils of the western part were formed directly from the subjacent rock and altered by wind, water and other atmospheric disintegrating agencies. The greater portion of the eastern part was formed by the materials transported by hill streams. The eastern part became more and more fertile than the western part. The Map (No. 4 ) shows the soil condition of the district in pre-independence era. "The Fever Committee showed that the fever was associated with relative infertility of the soil owing to lack of inundations, Dr.Elliot commented on the associated lack of cultivation".[22]

In the western part of the district, during nineteenth century, there were forests with human habitation. The land was not used for crop production. The western part was "at one time a wilderness of forests and jungles, but the culturable lands have now been almost entirely reclaimed and turned into good paddy fields".[23] Forests of tropical deciduous type were in strips in the plains, mainly along the river banks. The forests were reclaimed by man for growing crops. The map of natural vegetation (Map No. 4 ) shows the condition of forestry and natural vegetation in the past. Gradually the method and extent of cultivation has progressed.

Before Independence, areas of forest were more extensive in P.S. Kanksa, Memari, Purbasthali, Ausgram, Barabani, Salanpur and Jamalpur. The great deficiency of the district specially of

its western and central parts, was the proper supply of water for irrigation purposes. The methods of cultivation in the western part depended upon the storing of rain water, as there was no canal and other irrigation system. Wind erosion and, to some extent, water erosion took place over the western part. In the eastern part, where the velocity of water was high, sheet, rill and gully erosion took place. Until 1930, there was a great demand of water for irrigation purposes for all crops except for pulses at the western and west-central parts of the district. Then the western part was unfit for cultivation because the land was high and there was lack of water for cultivation. The land tenure was simple and method of cultivation was primitive, but gradually fallow land was turned into paddy fields. The following Table (1) shows the utilization of land sub-division wise during pre-independence period.

Table - 1

(Area in Hectare)

| | Total areas | Net cropped areas | Current fallow | Areas not available for cultivation | Culturable waste | Jungles |
|---|---|---|---|---|---|---|
| Burdwan | 332732.40 | 228219.04 | 12114.52 | 62677.88 | 20950.73 | 3258.63 |
| Asansol | 161751.94 | 91385. 90 | 4874.62 | 37714.37 | 3152.31 | 3152.32 |
| Kalna | 9888.60 | 73451.04 | 3358.75 | 11643.87 | 6532.32 | 1835.42 |
| Katwa | 104973.85 | 76715. 0 | 4404.25 | 15306.37 | 5902.55 | 849.53 |

Source : Ishaque, H.S.M. 1946 Part (1) pp. 20-25.
Agricultural Statistics by plot to plot, 1944-45.

Crop pattern and rotation of crops : Due to the introduction of cash crops such as jute, potato and the steady rise in the price of paddy the agricultural production was much better. During the year 1910-11, paddy production was good, but there was failure of jute on account of drought and sugarcane production, too was poor for want of proper manure. At the beginning of the twentieth century there was no regular system of rotation of crops. Before 1915, the percentage of existing fallow lands to net cropped areas was 45 and percentage of culturable waste to net cropped area was 24.5. Poverty as also shortage of food grains started from 1942-43. Upto the period 1945, the area under Aman paddy and Rabi crops increased in Burdwan and Asansol, but Bhadoi crops decreased due to drought in 1945. Jute was grown in Kalna and Burdwan. Moreover, the district of Burdwan was rich in potato. Asansol suffers mostly from drought. The western part was not fertile like the rest. The mixture of the two soils, such as laterite clay and red sand are most suitable for sugarcane cultivation and alluvium soil for paddy cultivation. During the period 1930-40, "the damage to crops by floods is believed to be about 10-15 per cent in the district as a whole".[24] Generally the worst affected areas were Pandaveswar Union (Asansol), the Police Stations of Katwa, Ketugram, Mongalkote, Rayna, Jamalpur and

Khandaghosh. Subhas Chandra Bose showed greater awareness to the economic problem. In his presidential address to the 1938 Congress, he called for "greater use of science and agricultural capital in order to increase output".[25] The Table (2) shows the acreage of different crops subdivision-wise during pre-independence period.

Table - 2

( Areas in hectares)

| Name of the crop | Burdwan | Asansol | Kalna | Katwa |
|---|---|---|---|---|
| Aman | 198540.15 | 73783.46 | 55094.01 | 63854.85 |
| Boro | 0.19 | - | 414.92 | 667.32 |
| Aus | 8347·0 | - | 8906.15 | 4592.17 |
| Gram | 1567.59 | 268.96 | 2771.29 | 1957.97 |
| Wheat | 1062.51 | 702.22 | 208.69 | 803.92 |
| Barley | 187.59 | ,47.18 | 70.55 | 235.06 |
| Musur | 1926.86 | 93.27 | 1878.35 | 1162.10 |

Table 2 contd.

Table - 2 (contd.)

| Name of the crop | Burdwan | Asansol | Kalna | Katwa |
|---|---|---|---|---|
| Mug | 503.94 | 3.28 | 220.56 | 372.27 |
| Maskalai | 1372.34 | 69.45 | 57.59 | 63.13 |
| Khesari | 329.83 | 1761.30 | 768.52 | 562.87 |
| Arhar | 14.90 | 705.79 | 222.06 | 189.94 |
| Maize | 31.18 | 381.75 | 5.38 | 13.40 |
| Sugarcane | 1165.30 | 1051.95 | 404.23 | 1214.79 |
| Groundnut | 0.44 | - | - | - |
| Mustard | 220.52 | 24.66 | 103.56 | 80.59 |
| Til | 114.05 | 26.44 | 82.01 | 125.83 |
| Potato | 3784.88 | 251.79 | 1186.41 | 831.83 |
| Jute | 469.03 | - | 1205.56 | 225.06 |
| Dofasali | 11989.42 | 2379.13 | 9672.01 | 5108.87 |
| Total cropped area | 240208.45 | 93765.07 | 83123.05 | 81823.81 |

Source : Ishaque, H.S. M. 1946 Part (1) pp. 20-25.

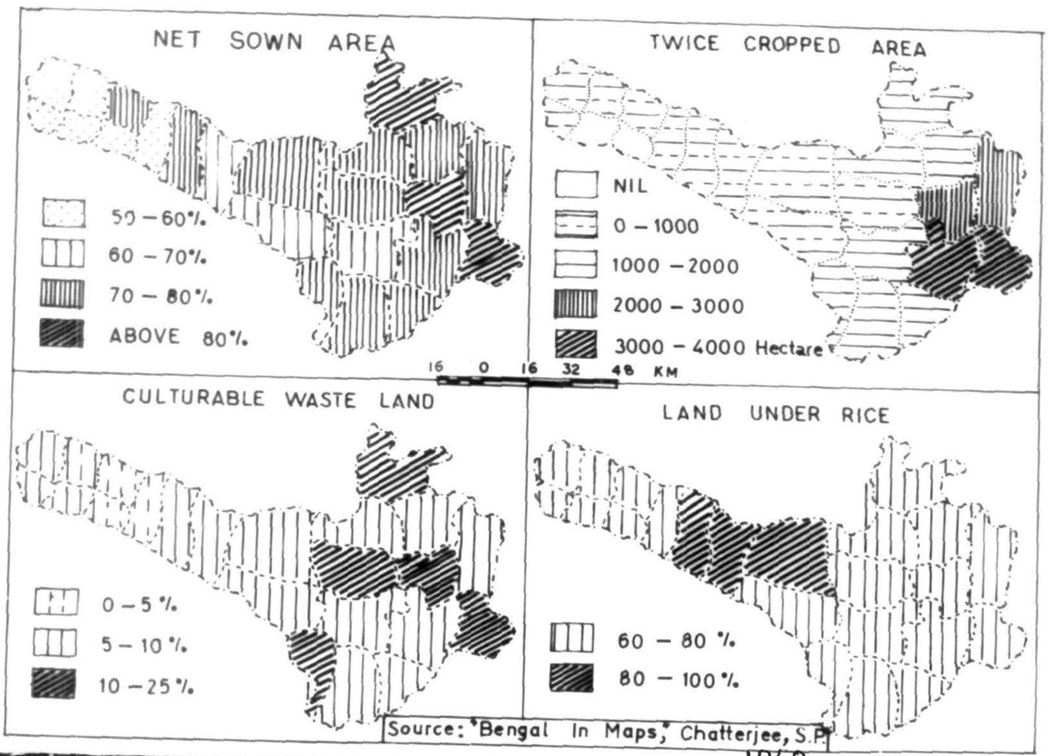

NET SOWN AREA
50 – 60%
60 – 70%
70 – 80%
ABOVE 80%
TWICE CROPPED AREA
NIL
0 – 1000
1000 – 2000
2000 – 3000
3000 – 4000 Hectare
16 0 16 32 48 KM
CULTURABLE WASTE LAND
0 – 5 %
5 – 10 %
10 – 25 %
LAND UNDER RICE
60 – 80 %
80 – 100 %
Source: 'Bengal In Maps,' Chatterjee, S.P.
1949

Fig. No. 5

According to 1931 census, there were 1,20,000 land owning farmers, 22,000 tenant farmers and 1,30,000 agricultural labourers in the district of Burdwan. The concentration of tenant farmers, agricultural labourers and land owning farmers were considerably more at the eastern part, south eastern part, central and eastern part of the district. There were low percentages of net cropped area (below 60 per cent) at the western part of the district. The Map (No. 5 ) shows that the eastern part of the district was agriculturally very productive than the western (above 60 per cent net cropped area to total area). During that period, the demand for agricultural labourers was highly seasonal (from April-May to August-September and November-December). The double cropped land in pre-independence era (Map No. 5 ) was about 18,225 hectares, which was high in Kalna, Memari, Purbasthali, Monteswar. The Map (No 5 ) shows that the culturable waste land was more (above 10 per cent) at the western part of the district. About 80 per cent of land was under paddy (Map No. 5 ) all over the district except in P.S. Faridpur, Kanksa, Ausgram, and Purbasthali due to presence of jungles. There were more lands (above 8000 hectares) under Aman paddy over the eastern part. There were smaller proportions of Aman land in the western tract due to the undulating high land and insufficient rainfall. The land under paddy was above 2500 hectares only in P.S. Purbasthali, Kalna and Jamalpur.

The low proportion of area under this crop was due to non-availability of favourable conditions. The land under Boro paddy was very low (below 600 hectares) in Katwa, Monteswar and Purbasthali, because of scarcity of irrigated water during January-March. Ketugram and Ausgram occupied above 400 hectares of land for wheat and jute was grown only in Purbasthali bordering the Bhagirathi. Potato was grown more in the south-eastern part of the district. During the period before Independence several other crops (maize, barley, gram, pulses and sugarcane) were produced in the district.

Land Tenure System :

Before Independence the land tenure system in Burdwan was of the intermediate rent paying type consisting of properties held under the Zamindars. The tenure system comprised "(a) Patni taluks with their subordinate Sepatni and Dar-patni tenures; (b) Mukarrarī tāluka, (c) Istimrārī taluks and (d) Ijāras including Dar-ijāras and Zar-i-peshgi-ijāras.

The tenures held by actual cultivators comprise (i) jamā or jot, (ii) meādi jama (iii) mukarran and maurasi jamā, (iv) Korfā and Dar-korfā and (v) bhag jot".[26]

From the nineteenth century, most of the lands began to be fragmented and scattered. The peasants preferred Aman crop,

which produced much more yield than Aus. Before Independence, the agriculture of Burdwan was in a stage of stagnation for a long period. "The reasons for this stagnation will have to be sought among the key variables such as land, labour, capital, technique and organisation on which depends the agricultural output".[27]

From the early days Burdwan got most of the advantages of irrigation from Government as well as private canals. After Independence the course of the river Barakar was interferred with due to the commencement of the Maithon Dam under the Damodar Valley Project. The cultivation of wheat had become popular and was making rapid progress in the eastern, northern and central parts. It will be noticed that after Independence more people depended upon agriculture than before.

Agriculture during the planning period : In the year 1950, the Fifth Plan programme was launched. During the First Plan (1950-51), the highest priority was given to irrigation and power system. During the Second Plan (1955-56), a new approach was made for agricultural development based on selectivity of area and concentration of efforts. There were no changes in techniques in the period from 1947 to 1950. Technological backwardness was responsible for the stagnation in agriculture. "Cropped area fluctuates with the prevailing weather conditions

and agro-economic situation. Total cropped area increases with the increase in the area sown more than once and decrease in the fallow area".[28]

During the first two plan periods, the irrigational facilities were increased in the district. As a result the proportion of net area sown was high under irrigation. Due to lack of suitable irrigation, monoculture was practised. Gradually the production of sugarcane declined because it takes about a year for production. "Sugarcane plantation, involving a great amount of labour, was found to be commercially unattractive. This is perhaps the main reason why acreage under sugarcane fell".[29]

<u>Present condition of agriculture</u> : In Burdwan double cropping was started in a small scale from planning period. Thus the scope of increasing double cropped area expanded gradually. In the district, there were no particular regions for certain crops. It is evident that the crop combination regions are highly dynamic and are subject to constant changes. 'The people's plan' suggests that the ultimate solution is collectivisation, because "the success of this plan for increasing the productivity of agriculture can be materially assisted through the promotion of collectivisation of agriculture in the place of the present cultivation of tiny, uneconomic holdings".[30]

If the farmers take recourse to Japanese method of cultivation it would be possible to improve the yields to at least 10 per cent, but the main problem is technological lag and farmers lack of training. The Intensive Agricultural District Programme (IADP) was adopted in 1960. The district of Burdwan reported higher output than other districts, During 1966-67, a new approach was initiated as strategy of agricultural development. In the fourth plan (1968-69), agricultural policy was given a new orientation for the good of weaker sections and backward areas. After 1966-67, from the period High Yielding Variety Programme was introduced in the district, traditional methods of cultivation was transformed into modern scientific methods. The new method i.e. HYV programme of paddy and wheat require improved seeds, sufficient and optimum irrigation, fertiliser, pesticides, bright sunlight, scientific or modern implements, more capital and assured fair market.

The new agricultural policy should ensure intensive utilisation of land, create widespread productive employment and reduce disparity. "The consolidation of fragments of land holdings into compact areas should be an important aspect of land policy since this measure results in both operational economy and production benefits."[31] There is

a number of serious obstacles to the widespread cultivation of high yielding varieties in the district. There is very great scope of improving the condition of agriculture in the district, but any such remarkable improvement has not yet been possible due to socio-economic negligence and technological lag. Many years have passed after the introduction of HYV programme, but it is strange that a part of the district (Western part) produces single crop of low yield and that, too, in monsoon season. There is a great disparity of agricultural technique and production between western and eastern parts of the district.

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# CHAPTER - II

## PHYSIOGRAPHY AND ITS RELATIONSHIP WITH AGRICULTURE IN THE DISTRICT OF BURDWAN

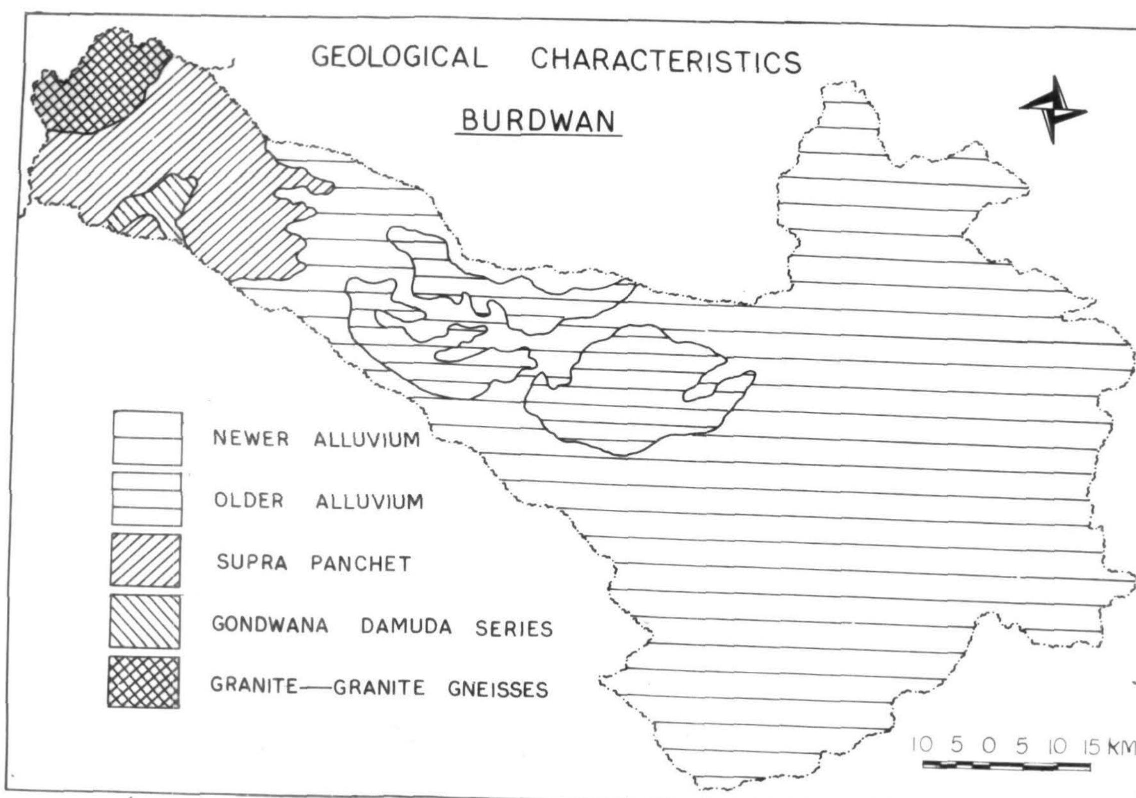
Introduction : As everywhere, Physiography exerts significant control on the spatial distribution of cultivated lands in the district of Burdwan. Relief may be regarded as one of the primary factors influencing spatial variations in the intensity of agricultural activities and land use. "Relief also influences farming by modifying the climate and affecting the ease of cultivation and the degree of accessibility".[1] All the physical factors affecting agriculture are interrelated, climate is modified by altitude and slope aspects; soils by relief, hydrology and climate; forestry by soil, relief, hydrology and climate.

The district of Burdwan, one of the western districts of West Bengal, is situated between 22°56' and 23°53' North latitude and between 86°48' and 88°25' East longitude. It is bounded on the north by Santal Parganas (Bihar), Birbhum and Murshidabad district, on the east by Nadia district, on the south by Hooghly, Midnapur and Bankura district, and on the west by Purulia district.

Geology of the district :

In the district of Burdwan there are various types of geological characteristics orginating in different periods. There is a homoclinal dip from north west towards southeast of the district. In the western part of Burdwan, the oldest rock, Archaean shield, the easterly extension of the Chhotonagpur peninsular mass has been traced below a thin Veneer of alluvium upto a zone passing through the west Galsi area. A number of huried domed structures of varying dimensions have been identified in this zone. Some of these structures are possibly only erosional features on the Archaean basement. The predominating rock is granite which in some places become gneissic and sandstone. These rocks contain quartz, felspar, tommaline and biotite. Later phase of these rocks are pegmatites, aplites and quartz veins. The Archaean terrain of the district constitutes a variety of rocks including phyllite, para and orthoschits, gneisses, anthrosite, various gnanitic rocks, epidiorites, dolerites, para gneisses and granulites.

In the archean tract in the western part, a number of fault has been recognised. This fault zone comprises a number of conspicuous hillocks or ridges either composed of schort gneiss or cherty quartz and quartzite with sporadic concentration of secondary iron ores. The Gondwana terrestrial deposits, which have a glacial boulder bed at the base




Source: Geological Survey Of India, Calcutta

Fig. No. 6

comprise a thick series of shales and sandstones interbedded with coal seams. These immense deposits which range in age from the upper carboniferous to the lower cretaceous have been subdivided into a number of series viz. Talchir, Damuda and Panchet forming the lower Gondwanas. Gondwana rocks of the Raniganj Coal Field are intruded by a large number of igneous intrusions comprising the doleritic or basaltic dykes and ultrabasic mica peridolite and lamprophyne dykes and sills. Supra Panchets of upper Gondwanas are seen in the south eastern part of Asansol Sub-division and they consist of coarse red, yellow and grey sand stones and quartz conglomerates with bands of dark red shales. Sandstone with shales are present in the western part of the district. The oldest rocks, the Talchirs, are exposed adjoining the northern boundary.

Durgapur beds are possibly estuarine counterpart of the shallow marine environment. They consist of laterite, sandstone felspathic grits and mottled clays and are considered, at least in part, belonging to the upper Tertiary age. Laterites and lateritic soil is limited to central part of Burdwan district, which are known to be formed by sub-aerial weathering of almost all types of rocks in a monsoon climate with alternate dry and wet seasons. In the district,laterites are ubiquitous in the Raniganj Coalfield and isolated occurrences of laterites over undoubted Tertiaries have recently

been observed. As such these laterites are considered younger in age than the Tertiary, possibly ranging in age upto pleistocene of the Quartrnary era. (Fig No 6.)

"Laterites are usually succeeded by the next younger group of sediment (alluvium) of the Quaternary era".[4] The thickness of the Quaternary sediments is 40-50 metre at places in the western parts and increases to more than 150 m. in the eastern parts of thedistrict. Alluvium occupies the major portion of the district. Lithologically, the sediments consist of massive beds of clay either sandy or calcareous. These alluvial deposits have been classified into two groups -- older and newer alluvium. Older alluvium is of 'Middle Pleistocene age', and in coarse and composed of assorted boulders, pebbles, gravels. They are generally reddish in colour containing abundant dissemination of calcareous and limonite concretions. Newer alluvium is of 'sub-Recent to Recent age' and is mostly confined to the banks and beds of present day river channels. They consist of typically dark and loose unconsolidated sediments having high water content and a good amount of organic matter. The granular zones within the alluvial fill are saturated with ground water. The alluvial fill tends to thicken towards east and southeast. Towards the west the alluvial mantle thins out and occurs as a mere

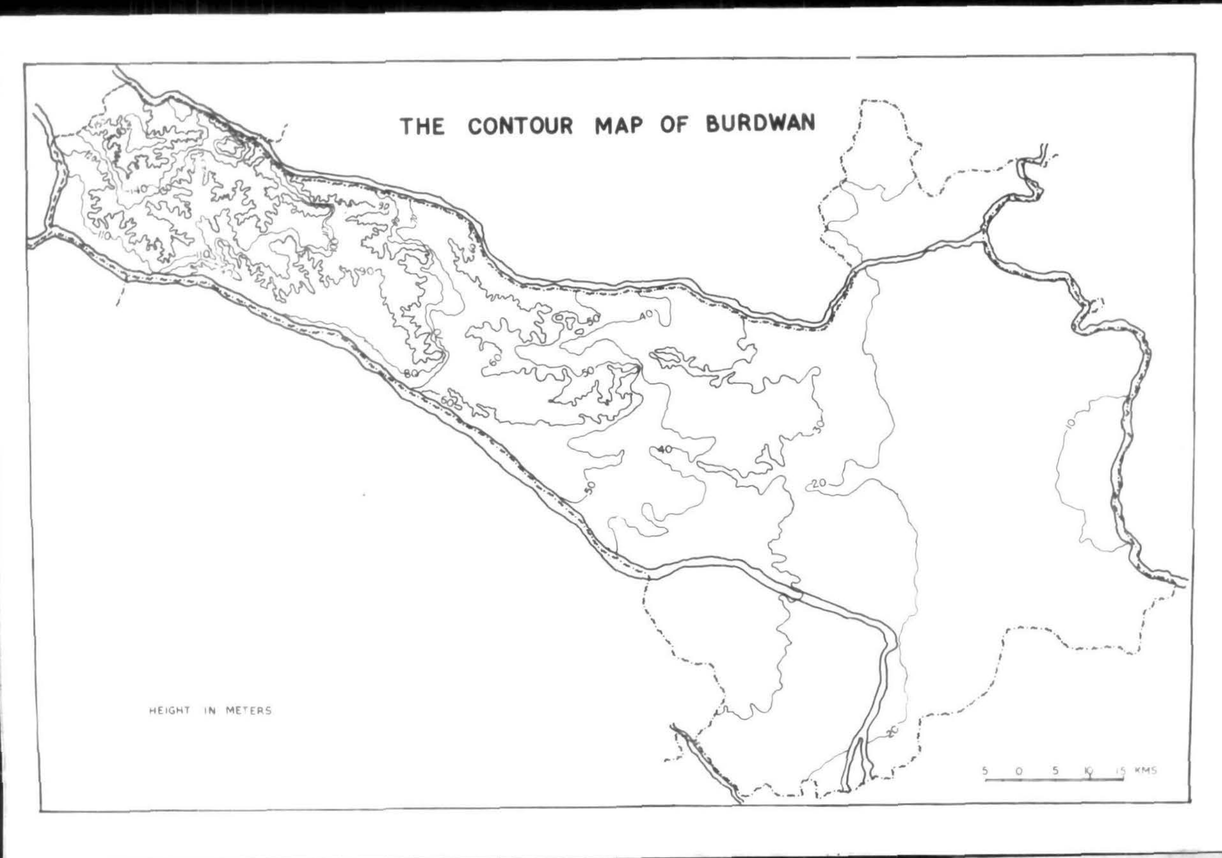



Fig. No. 7

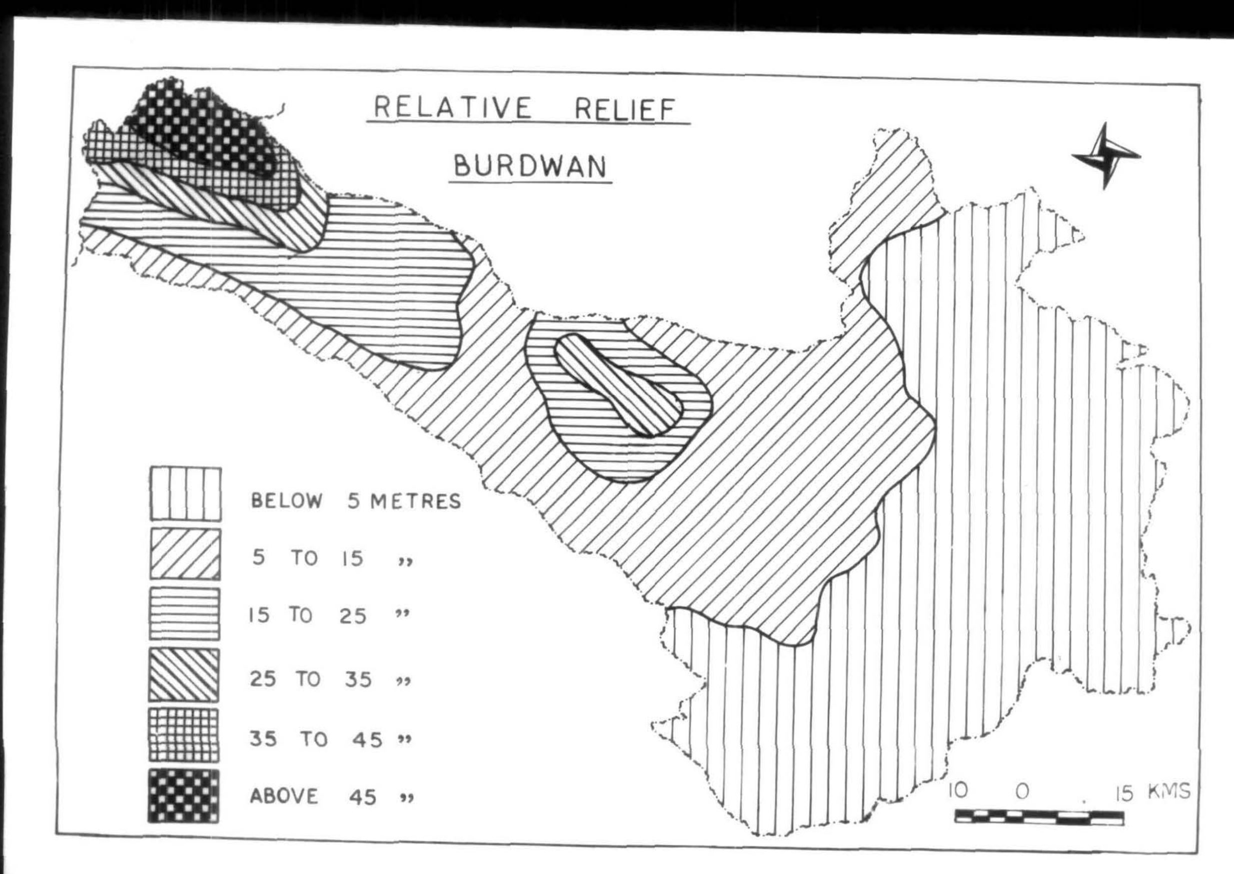



Fig. No. 8

capping on the Tertiary - Gondwana terrains. Towards west of the district the clay capping thins out 2 to 2.5 m or even less.

Topographic generalities of the district :

The region presents a variety of land forms. The contour and drainage maps (Fig. No. 7 & 10) clearly establish that the general slope of the region is from north-west to south-east. The distribution of contour is from 10 metres in the east to 160 metres in north west with 10 m countour intervals. In the eastern part the contours are distributed far apart from each other, whereas contours are closed with various notches at the western part of the district. There are two hills of about 230 m near Maithon in western Salanpur. Besides these there is a large number of rocky outcrops of above 200 m. in Kulti, Salanpur, Chittaranjan, Barabani, Hirapur and Asansol. There are also several rocky outcrops of above 150 m in Faridpur, Durgapur, Andal, Raniganj and Jamuria. There is a small number of rocky outcrops of above 75 m in Kanksa and Ausgram.

The relief is characterised by a slow gradient from the north west to the south east which is apparent from the direction of flow of the rivers. Relative relief map (Fig. No. 8 ) shows, that the highest relative height at north

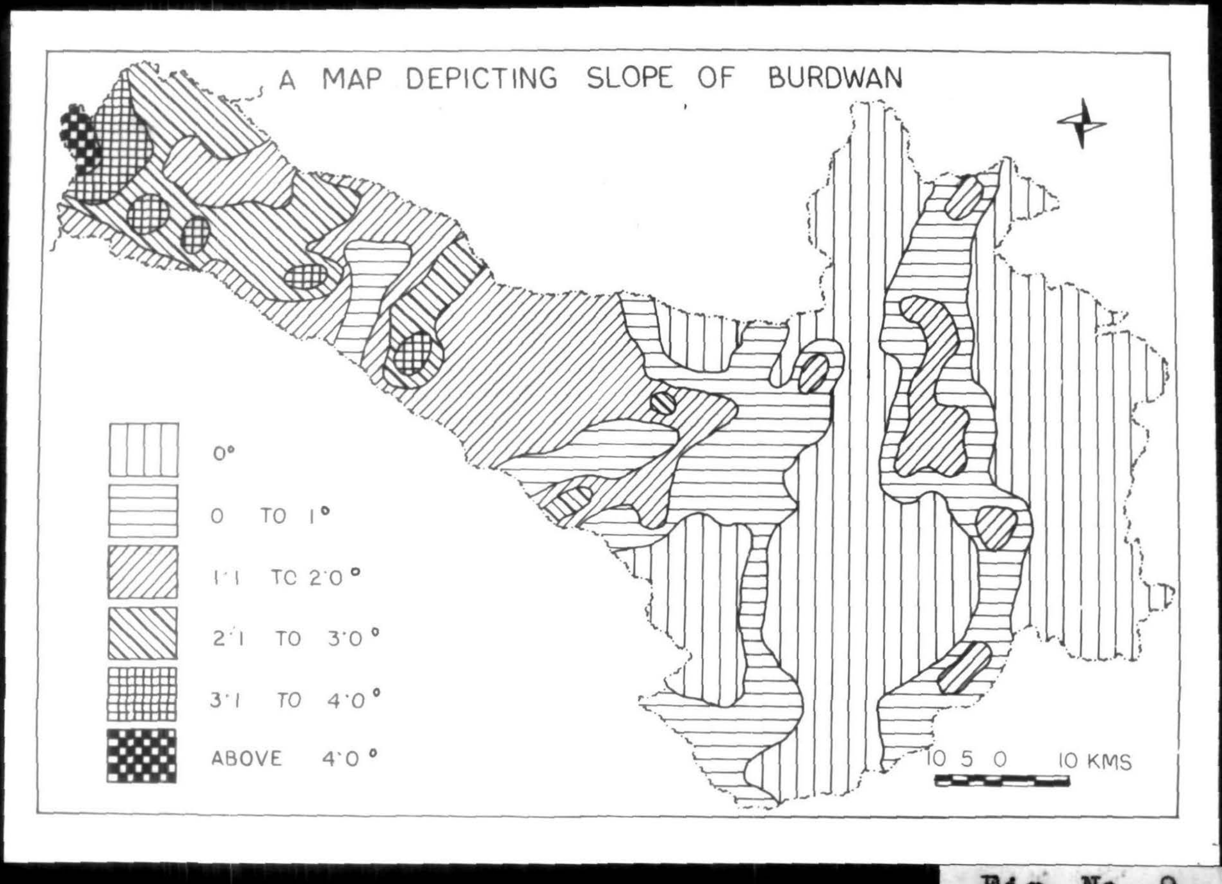

A MAP DEPICTING SLOPE OF BURDWAN
0°
0 TO 1°
1·1 TO 2·0°
2·1 TO 3·0°
3·1 TO 4·0°
ABOVE 4·0°
10 5 0 10 KMS

Fig. No. 9

western part of the district. The isopleths are drawn at 10 m. intervals. The 15 m. relative relief line passes through Andal-Faridpur P.S. At the western side of this area the isopleths are very close i.e. the topography is steep and gradually descends step-like in central part of the district. Another high area is noticed at the central part near Durgapur-Kanksa P.S., where the topography is undulating. Towards the eastern part of this area the relative height is low (below 15 m) and almost plain. The relief falls suddenly to 15 m. at the east central part of the district.

"Wentworth's method",[5] (Fig. No. 9 ) confirms that the slopes are steep and subject to fairly high rill erosion and gully erosion. The slopes are shown in degrees. There are a few patches of plain land at the eastern part of the district. Steep slopes (above 3°) are seen near the P.S. Kulti, Salanpur, Hirapur, Asansol, Raniganj, Andal and Faridpur. At the eastern part of the district the gradient of the slopes is gentle, which ranges from 0-2°. The rolling uplands, where the slopes are steep, may be subject to denudation. This is partly due to the deforestation which had been rampant for a considerable time.

The drainage of the district is characterised by a network of rivers flowing down from the west to the east, with high fluctuations of discharge and sediment load

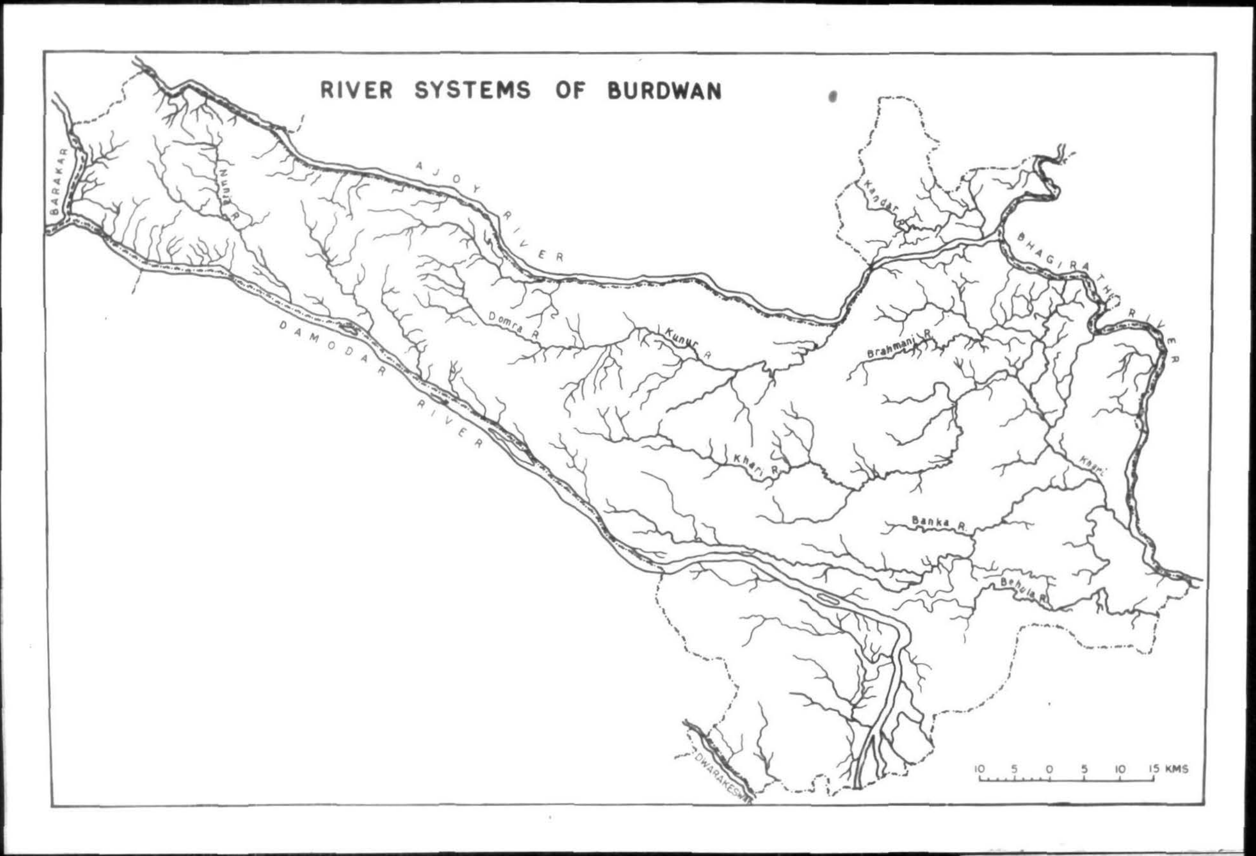

RIVER SYSTEMS OF BURDWAN
BARAKAR
Nunia R.
AJOY RIVER
DAMODAR RIVER
Domra R.
Kunur R.
Kandar R.
BHAGIRATHI RIVER
Brahmani R.
Khari R.
Banka R.
Behula R.
DWARAKESWAR
10 5 0 5 10 15 KMS

Fig. No. 10

synchronising with the period of maximum discharge during the monsoon. Figure 10 explains the condition of the rivers. The river Ajay originates from the heights of the Santhal Parganas along the northern boundary and drains a large portion of their western and southern slopes. Its confluence with the Bhagirathi is at Katwa. In the western portion of its course, the channel is comparatively straight and the banks are well defined. The river Ajay typifies a non-perennial rainfed river with sinuosity of its course, heavy fluctuations of discharge and high amount of river load carried down from the Trap region of the Rajmahals. The river is still now subject to the vegaries of nature causing inundation over large areas. The Damodar rises in the Chotonagpur water-shed along the southern boundary and after a southeasterly course of about 564 Kms., falls into the Hooghly. The course of the river is tolerably straight and is full of sand banks. The Damodar, rain-fed river, originates from the Hazaribagh Plateau and is liable in the lower part of its course to sudden floods which have caused much damage in the past.

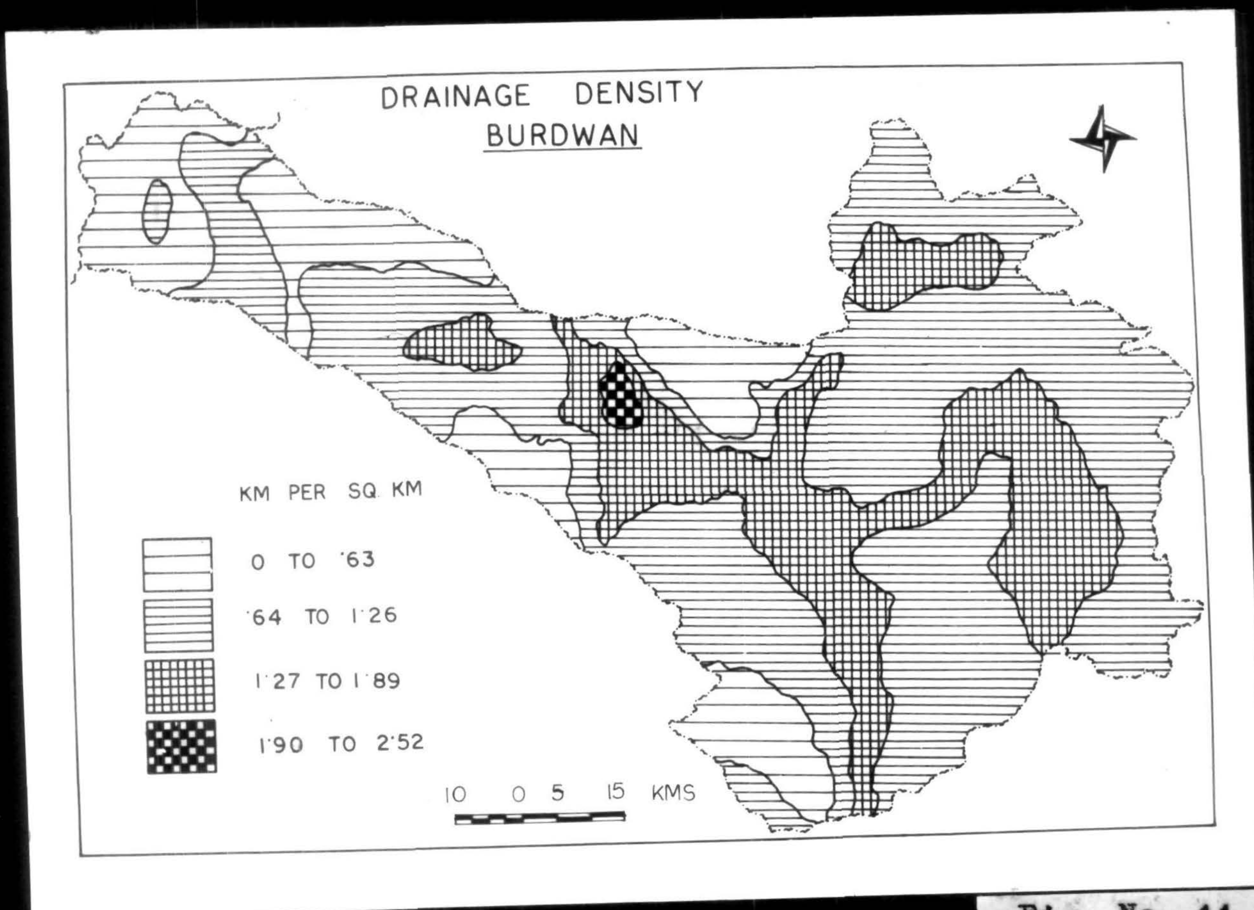
The Bhagirathi or Hooghly forms the whole eastern boundary of the district with the exception of a short distance where it enters the Nadia district. The average breadth of the river is about 1.6 Kms and the bed is full of sand.

The Rarh plain occupying the area in between the Ajay and the Damodar is drained by a number of small rivers originating and flowing from the western part of the district to the east and ultimately falling into the river Bhagirathi. In the northern part, the Kunur river, a tributary of the Ajay, rises in the undulating country north of Kanksa P.S. and falls into the Ajay near Mangalkote occasionally over-flowing its banks. Further south, the river Khari takes its rise near the P.S. Budbud. It was formally one of the many offshoots of the Damodar. The river after its confluence with the Banka in the lower reaches joins the river Bhagirathi. The Banka, the principal tributary of the Khari, rises near Galsi. The Behula is another moribund channel flowing into the southern part of the district. The Nunia merges into the Damodar at Raniganj from north west flowing like a hill stream. The Singaran and Tamla are tributaries of the Damodar. The Kana is an offshoot of the Damodar. The Brahmin and Babla are tributaries of the Bhagirathi. Both of them fall into the Bhagirathi near Katwa. All these non-perennial streams are characterised by extreme sinuosity in their courses undoubtedly owing to their drainage over lowland tracts of the district.

The chronic floods and devastations have been con-trolled with the construction of the dams and barrage at Durgapur in the upper course simultaneously with the cons-truction of canals. The construction of storage reservoir

as an outlet of the excess water during the high monsoonal discharge is considered as a very feasible suggestion for amelioration of difficulties, such as floods, water-logging and the like. There being no scope for the water to drain out quickly, the water spreads in the catchment area causing floods. Floods are a regular feature in the district in some years they create havoc, while in others they do not do so. The beds of the rivers have become shallow due to continuous silting which again limits the capacity of holding excess water. The floods have had some beneficial effects by way of enriching and fertilising the soil by deposit of silt and minerals, as well as irrigating the lands.

It is equally true that any viable programme for regional flood control must have rationalised water management as its integral part. It has been found that the flood hazards are more or less recurrent phenomenon due to the interference of the ecology of the drainage system. It has further been found that the flood havocs lead to crop failures resulting in the deterioration in the economic condition of the cultivator class. There is thus a system of checks and balances of geomorphology and water management in the overall crop ecology under the impact of frequent flood hazards.



DRAINAGE DENSITY
BURDWAN
KM PER SQ. KM
0 TO ·63
·64 TO 1·26
1·27 TO 1·89
1·90 TO 2·52
10 0 5 15 KMS


Fig. No. 11

There are small jhills and swamps in which water remains throughout the year in the eastern part of the district.

The Figure 11 shows the drainage density that concentration of drainage which varies spatially in the district. It ranges from 0 to 2.5 km/sq.km. from west to east. Drainage density is not too low as there is a large number of streams and rivulets perennial or non perennial flowing all over the district. There are a few small patches of low drainage density in southern (Khandaghosh P.S.), north central (Ausgram P.S.), west central (Durgapur, Kanksa P.S.) and extreme western (Chittaranjan, Salanpur, Kulti, Hirapur and Asansol) part of the district. The cultivated area can benefit from perennial rivers, where drainage density is more than 1 km/sq.km. and at the adjacent area of the river Ajay, Damodar and Bhagirathi.

The District is sub-divided into different topographic generalities. This classification (Fig. No. 12 ) is based upon the variability of relief, slope and swampy area of the district. There are mainly three types of classification :

1. Plateau fringe area or western upland,
2. Zone of degradation,

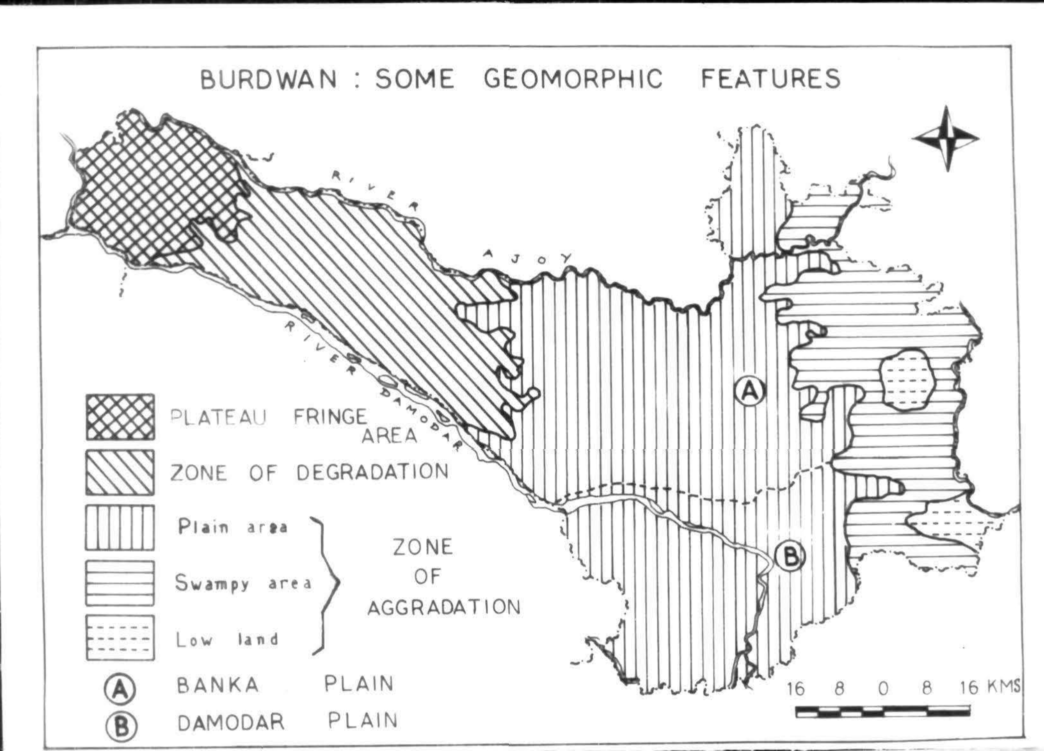



Fig. No. 12

Bad land features - that developed due to deforestation, fluvial and aeolian action in Barabani P.S.

3. Zone of aggradation,

(a) Plain area

(i) Banka plain and

(ii) Damodar plain.

(b) Swampy area,

(c) Low land and

(d) Levee.

(1) Plateau fringe area - It occupies the extreme western part of the district. There is a large number of hillocks, rocky outcrops with considerable undulation. The slope is steep with rough surface and the soil cover is thin and loosely developed from the decomposition of subjacent rocks. The principal character that marks them out as hills is the abruptness of their rise. Rill and gully erosion is very active over this area. The margin of this Zone is marked by 100 m. contour line, beyond this area the characteristics of the above classification gradually becomes less and less noticeable.

(2) Zone of degradation - The Zone is limited upto 50 m. contour line. Within this zone the slope becomes gentle but perceptible, small hills and rocky outcrops become rarer. The undulation gradually diminishes from west

to the east. The degradational topography represents a transition between the extensive depositional plain to the east and plateau fringe area to the west. From agro-economic point of view, the picture of the past is very different from that of the present. The plain land of the above two zones with better availability of water is cultivated to the maximum possible extent. On the eastern periphery of the Zone of degradation multiple intensive cropping is practised.

(3) Zone of aggradation - This depositional zone extends from 50 m to 15 m contour line from west to east. The aggradational zone, from very early times had been the principal seat of agricultural activities in this district. Aggradational plain beings with the off-take of distributaries and anastomosing of rivers. It is composed of several "mini-deltas".[6] This is the richest agricultural area, where all available lands are used for paddy cultivation. The eastern part of this zone is also subdivided into "Banka plain" and "Damodar plain".[7] The northern part through which the Banka flows may be called Banka plain, whereas the southern portion with the Damodar as its principal source of water for irrigation may be referred to as the Damodar Plain.

Swampy area - It is limited by 15 m contour towards the eastern boundary of the district and it is also known as

a flood plain area. The banks of the streams in this area are low and friable, thereby permitting overflow. This plain land is very fertile and is used for multiple cropping. One disadvantage is that the area is affected frequently by devastating floods.

At the eastern periphery of the swampy area lies the low land. This low lying marshy depressions filled up with alluvium have been reclaimed for agricultural use. The best known low lands are "Dogachia low land" near Katwa and Purbasthali P.S. and "Dekoimarsh" near Kalna P.S. The marshes lie in a concentric manner parallel to the contour lines. These depressions are mainly caused by unequal aggradation of the Damodar and the Ajay group of rivers.

Along the western bank of the Hooghly a low but conspicuous ridge or levee has been formed. In early days it was natural formation but at present it is man-made and is built up by recent alluvium. This levee is not suitable for cultivation unlike the other depositional zones.

Table 1

| Name of P.S. | Slope Index | Cultivated area (in hectares) 1955(a) | 1971-72(b) |
|---|---|---|---|
| Salanpur | 100.0 | 6244 | 3951.5 |
| Barabani | 65.0 | 9947 | 7693.0 |
| Kulti | 60.0 | 4353 | 4520.0 |
| Hirapur | 58.0 | 2997 | 2577.5 |
| Raniganj | 55.0 | 3480 | 1473.5 |
| Faridpur | 55.0 | 16194 | 14005.0 |
| Asansol | 50.0 | 3955 | 1349.0 |
| Jamuria | 45.5 | 14231 | 11807.0 |
| Andal | 43.5 | 10014 | 5379.5 |
| Ausgram | 40.5 | 35260 | 41817.5 |
| Galsi | 40.5 | 34363 | 53279.0 |
| Kanksa | 32.0 | 12529 | 11647.5 |
| Mangalkote | 30.0 | 29905 | 30800.0 |
| Monteswar | 29.0 | 24158 | 31610.6 |
| Jamalpur | 29.0 | 22095 | 38584.5 |
| Bhatar | 28.0 | 32776 | 43279.5 |
| Memari | 26.0 | 34801 | 62432.5 |
| Khandaghosh | 15.0 | 21897 | 44795.5 |
| Ketugram | 14.0 | 31938 | 31376.5 |
| Katwa | 14.0 | 29116 | 37224.5 |
| Burdwan | 13.5 | 29035 | 44686.0 |
| Raina | 12.5 | 39418 | 46352.5 |
| Purbasthali | 7.0 | 30842 | 37642.5 |
| Kalna | 6.0 | 30047 | 37620.5 |

Source : (a) Directorate of Land Revenue and Land Record, Government of West Bengal (unpublished).
(b) Government of West Bengal District Census Handbook, Burdwan 1971.

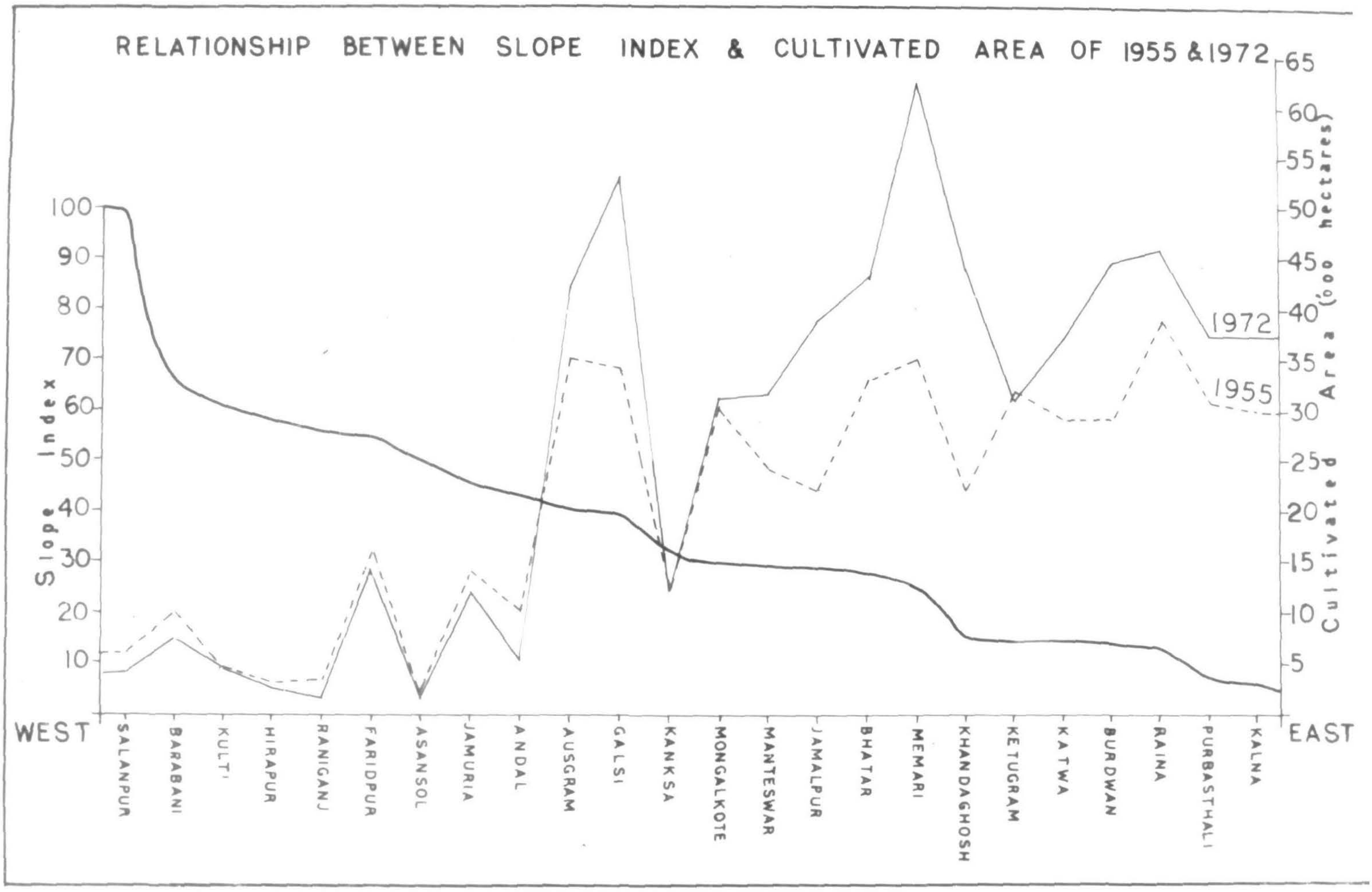

RELATIONSHIP BETWEEN SLOPE INDEX & CULTIVATED AREA OF 1955 & 1972
Slope Index
Cultivated Area ('000 hectares)
100
90
80
70
60
50
40
30
20
10
65
60
55
50
45
40
35
30
25
20
15
10
5
1972
1955
WEST
EAST
SALANPUR
BARABANI
KULTI
HIRAPUR
RANIGANJ
FARIDPUR
ASANSOL
JAMURIA
ANDAL
AUSGRAM
GALSI
KANKSA
MONGALKOTE
MANTESWAR
JAMALPUR
BHATAR
MEMARI
KHANDAGHOSH
KETUGRAM
KATWA
BURDWAN
RAINA
PURBASTHALI
KALNA

Fig. No. 1

**Relation between topography and cultivated area :**

The dependence of agriculture on topography can be best understood from the correlation between area under cultivation and slope (Fig. 13 ). In the figure, it is seen that maximum slope is the highest slope index. Then all the slope variability can be calculated in relation to the highest slope index. It is very clear in the figure that cultivated area varies spatio-temporally. There is indirect relationship between slope-index and cultivated area during 1955 and 1972. In 1972 the cultivated area abruptly increased in Galsi and Memari. In Ausgram, Monteswar, Jamalpur, Katwa, Burdwan, Rayna, Purbasthali and Kalna the cultivated area more or less increased after 1955. But in the western part where topography is the primary obstacle to agricultural improvement, there is a marked degradation of cultivated area in relation to the eastern part of the district. This implies that the extent of cultivated land varies in close conformity with the nature of the surface topography. The water cannot be stored at the slopy western part as the maximum amount of water outwashes through the slope or penetrates down.

Table 2

| Name of P.S. | Contour Value (in metres) | Net cultivated area as percentage to geographical area |
|---|---|---|
| Salanpur | 130-160 | 24.81 |
| Barabani | 120-150 | 47.91 |
| Kulti | 120-140 | 51.10 |
| Hirapur | 90-120 | 29.84 |
| Raniganj | 75-95 | 13.30 |
| Faridpur | 65-90 | 41.61 |
| Asansol | 90-110 | 19.37 |
| Jamuria | 80-120 | 44.54 |
| Andal | 70-90 | 27.83 |
| Ausgram | 40-55 | 61.26 |
| Galsi | 45-60 | 69.72 |
| Kanksa | 55-75 | 30.97 |
| Mongalkote | 20-30 | 67.80 |
| Monteswar | 15-20 | 84.85 |
| Jamalpur | 15-20 | 79.20 |
| Bhatar | 25-40 | 72.44 |
| Memari | 15-25 | 81.37 |
| Khandaghosh | 30-40 | 79.31 |
| Ketugram | 15-25 | 71.67 |
| Katwa | 10-15 | 73.94 |
| Burdwan | 25-35 | 65.71 |
| Raina | 25-30 | 80.38 |
| Purbasthali | 10-15 | 71.09 |
| Kalna | 10-15 | 76.59 |

Source : Topographical Sheet,
1971 District Census Handbook, Burdwan.

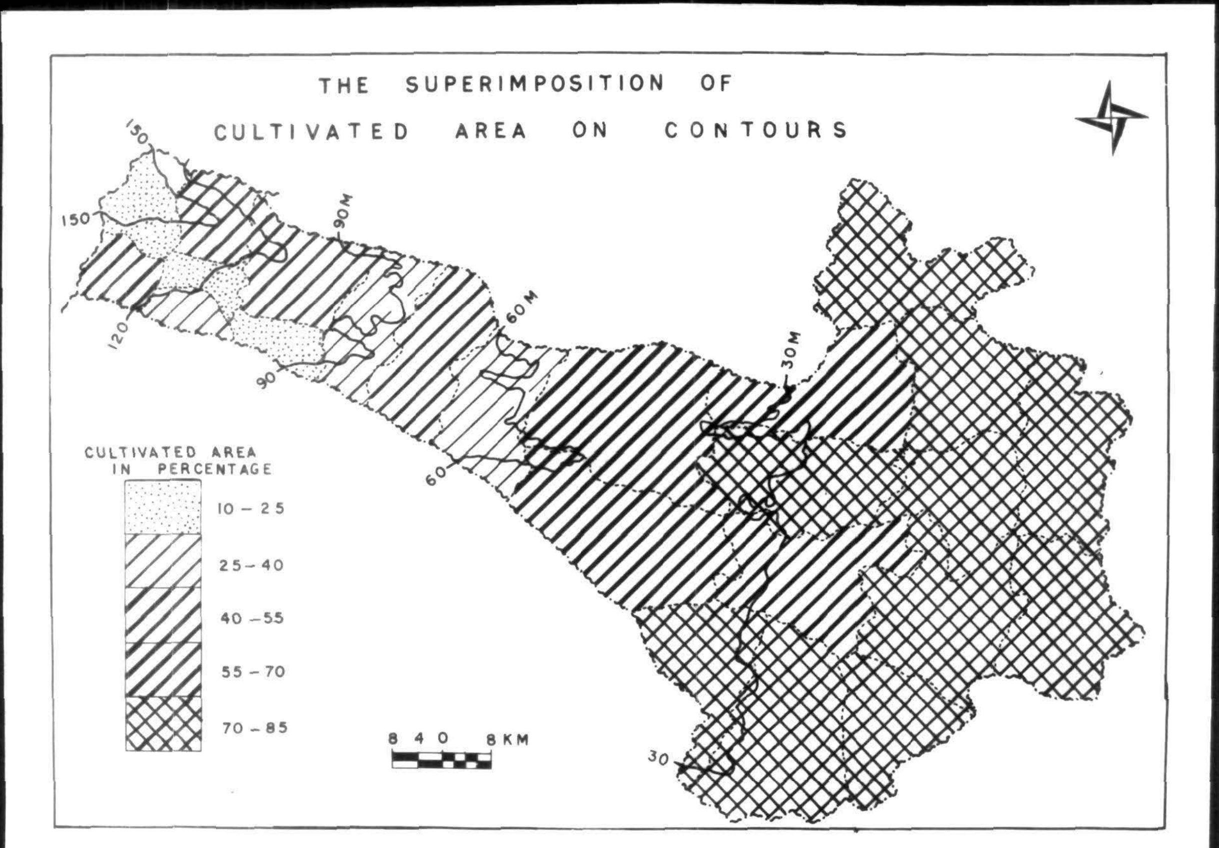

THE SUPERIMPOSITION OF
CULTIVATED AREA ON CONTOURS
150
150
120
90M
90
60M
60
30M
30
CULTIVATED AREA IN PERCENTAGE
10 – 25
25 – 40
40 – 55
55 – 70
70 – 85
8 4 0 8 KM

Fig. No. 14

Figure 14 explains that cultivated area depends upon the land forms of the district. The net sown area expressed as percentage of total geographical area when superimposed on the contour map, shows that 70-85 per cent cultivated areas are occupied by all the Police Stations at the eastern part ofthe district. This fertile zone extends from 30 m contour to the eastern boundary except Mongalkote and Burdwan. 10-25 per cent cultivated area are occupied by several Police Stations (Salanpur, Asansol and Raniganj) at the western part. In the western part other areas occupy 25-55 per cent net sown area, whereas the area in between 30-60 m contour belongs to 55-70 per cent net sown area.

From the foregoing topographical analysis it can be argued that the agricultural land varies spatially from west to east due to the influence of physiography. The social factor, i.e. modernization methods have its own impact too, which is manifested through the changing nature of land utilization. The acreage increases in the central and eastern part of Burdwan district due to canal irrigation. The development of this area has been caused essentially by the present topography of vast plain land with perennial water sources. Physiography has modified the nature of land from west to east - West is sloping and devoid of any perennial source of water; the eastern part is a vast plain land

with natural irrigational facilities. But strangely enough, the social factors have followed the rule of nature for example, modernisation methods have been applied more in the bountiful east rather than in the barren west, where there is a greater necessity of these methods. The modernization is expressed temporally through the changing nature of land utilization practice. Hence it is found that while the eastern part of the district has been able to increase its acreage of agricultural production through double and multiple cropping practices with the help of canal irrigation; the physiographically and socially deprived west still falters to carry through even a monocrop system. The above findings thus readily prove that in this era of technological progress, the district of Burdwan still depends on physiography in the particular sphere of economic activity.

## FOREST AND ITS IMPACT ON AGRICULTURE IN THE DISTRICT OF BURDWAN

There is a significant relationship between forest cover and agriculture. The forests of the Burdwan district are of tropical deciduous type. The natural vegetation mainly depends upon topographical characteristics and climatic conditions of the area. In other cases, the type, density and area of forests also control the moisture holding capacity and organic matter content of the soil and rainfall characteristics of the area. These are the basic factors for agricultural productivity of any area. In the district of Burdwan cultivated plants have replaced wild vegetation.

There were vast dense forests all over the district during sixteenth and seventeenth centuries. In the early nineteenth century, after Muslim invasion of the country, the clearance of forests started. The increasing pressure of population and the construction of railway accelerated the process of deforestation. In the past, the western half of the district i.e. Asansol and Durgapur Sub-division were largely forested. In the early twentieth century some portions of forests were cleared for expanding the area for mining industrial and agricultural operations. In the west the forested area was opened up for factories and industries,

while agriculture started occupying the eastern parts. Along the river banks in the plains forests cover long strips of areas. In the past, when the rivers became moribund and failed to supply silt, agricultural production rapidly declined causing considerable land to lie fallow and revert to jungle. Before Independence, the areas of deciduous forests were very much in existence in Purbasthali, Ausgram, Kanksa, Faridpur, Memari, Barabani and Salanpur in comparison to those of Burdwan, Jamalpur, Kalna (200-700 hectares). Small areas of forests covered (below 200 hectares) land in other Police Stations of the district.[9]

There is a close correspondence between soil and natural vegetation of a tract. Forest cover increases the humus content in soil. Climate on the other hand, is the major determinant of vegetation. In this context rainfall is more important than temperature. The density of forests also varies with the depth of underground water table. Further soil factors play a decisive role in controlling the distribution of species. Where there is a high Carbon-Nitrogen ratio, the lands are covered by forests. On the other hand in conditions of high temperature, the organic matter of the soil decomposes thereby forming a low C-N ratio. Hence productive capacity of the soil diminishes. Thus it is found that the subsurface water table and the

organic content of the soil positively affect the sustenance of the forests.

The total forest area of the district in 1960-61 was 28184.50 hectares and in 1970-71 was 11112.5 hectares. The map shows that there are discontinuous patches of forests all over the district of Burdwan. During a decade the forest area has been reduced to less than a half.

Following is the distribution of the forest areas in Burdwan District (in hectares) :

| | | | | | |
|---|---|---|---|---|---|
| Burdwan | - | 4 | Barabani | - | 1239 |
| Raniganj | - | 7 | Faridpur | - | 1060 |
| Rayna | - | 48 | Kanksa | - | 5934 |
| Jamuria | - | 50 | Ausgram | - | 7314 |
| Andal | - | 25 | Khandaghosh | - | 10 |
| Galsi | - | 41 | Katwa | - | 26 |
| Salanpur | - | 91 | Budbud | - | 1147 |
| Bhatar | - | 266 | Kalna | - | 17 |

[ Source : District Census Hand Book, 1971, Burdwan ]

Ausgram has the largest forest area and next to it come Kanksa, Barabani, Faridpur, Bhatar, Salanpur, Galsi, Andal, Jamuria, Rayna, Raniganj and Burdwan. The map shows that there are continuous plots of forests in the central part

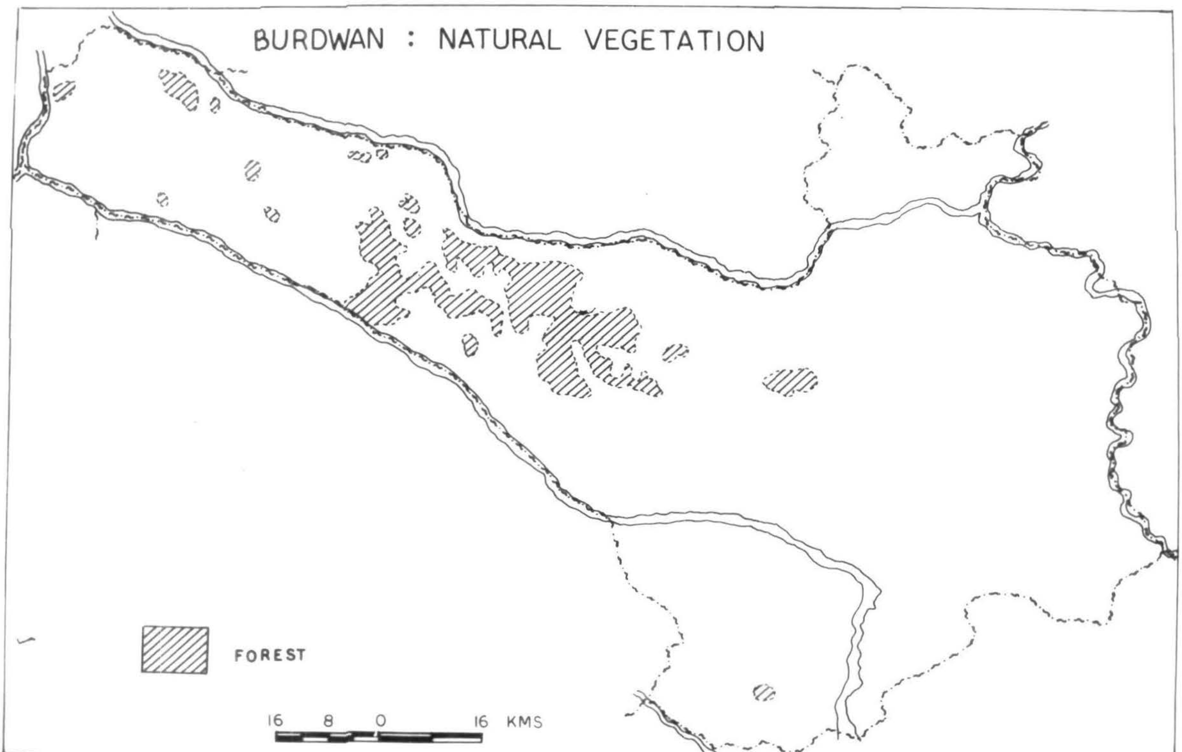



Fig. No. 15

of the district. Several small scattered patches of forests are found to exist in the western, south-central and southern parts of the district. (Fig No. 15)

A map of natural vegetation of the whole district shows the existence of several kinds of trees. The distribution of the commonly found varieties of species is given below :

| | | | |
|---|---|---|---|
| Salanpur | - Sāl, Ficus. | Kanksa | - Sāl, Babla, Ficus. |
| Barabani | - Sāl, Babla. | Ausgram | - Sāl, Bamboo, Banyan. |
| Raniganj | - Palās, Ficus. | Galsi | - Sāl, Bamboo,Banyan. |
| Jamuria | - Palās, Ficus. | Bhatar | - Nim,Banyan, Bamboo. |
| Faridpur | - Sāl, Babla, Arjun. | Burdwan | - Nim, Bamboo, Aceacia. |
| | | Rayna | - Nim, Bamboo,Accacia. |
| Andal | - Sāl, Palās, Ficus. | | |

The Sāl and other large leaved plants produce a thick canopy which protects the soil from being hit directly by the raindrops and strong wind and thereby reduces the destructive effect of intense runoff and erosion. If the thick canopy is removed by repeated cuttings, the protective action ceases and the soil is exposed to the agents of denudation. In some areas of the district the natural vegetation consists of grass only. Grass cover also protects the exposed soil from denudation and increases the organic matter content of the soil.

Significant changes in soil productivity occurs due to the depletion of the forests. A great failure of the plant-soil complex thus adversely affects the peasantry. A land with good vegetation cover does not erode easily. In Burdwan district,the western parts in P.S. Barabani, Salanpur, Hirapur, Raniganj, Jamuria, Faridpur, Kanksa, Ausgram forests have been cleared for industrial purposes where lands were and still are mostly barren. Comparatively, the eastern part has suffered less from this type of erosion. The barren land is susceptible to wind and water-erosion. Deforestation also has a harmful effect over the rainfall and weather conditions. In Burdwan district, heavy pressure on forest lands exists due to the demand for cultivation, river valley projects, industrial and many other economic activities.

Forest covers are of vital importance in increasing the effectiveness of precipitation by checking runoff, maintaining the water table and increasing humidity by transpiration. The value of forests is being recognised more and more, for conservation of moisture, prevention of erosion and for development of agriculture, industries and communications. "The first step towards conservation was made in 1855, and in 1878, a Forest Act set out the general policy of reservation and protection".[10] The importance of afforestation and soil conservation was emphasised for the first time in

the Second Plan. In the Third Plan, Planning Commission observed that progress on farm forestry programmes had been somewhat slow. It was recognised that the natural vegetation modifies the climatic condition of the district. Vegetation also greatly influences the organic matter content of the soil. "Farm forestry would also increase labour utilisation on the farm and help in soil and water conservation and thus indirectly raise agricultural productivity".[11] It may be said that with proper planning and application of modern scientific technique, it would not be difficult to increase the yields very substantially. It is necessary to maintain the natural vegetation for a better balance of water and soil through the different seasonal distribution of rainfall, as also for ecological equilibrium up to a certain level amongst water, soil, plant and economy. It may be concluded, therefore, that farm forestry has an indirect impact on agricultural production in the district of Burdwan.

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| | | | | | |
|---|---|---|---|---|---|
| Babla | - | Accacia arabica | Banyan | - | Ficus benghalensis |
| Sāl | - | Shorea robusta | Bamboo | - | Bambusa arundinacea |
| Palās | - | Butea frondosa | Nim | - | Melia azadirachta |
| Arjun | - | Terminaria arjuna | Ficus | - | Ficus religiosa |

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Data collected from :

Topographical, sheet, 1" = 1 mile. Survey of India. Calcutta. [73 $\frac{I}{13}$, $\frac{I}{14}$; 73 $\frac{M}{1}$, $\frac{M}{2}$, $\frac{M}{6}$, $\frac{M}{7}$, $\frac{M}{10}$, $\frac{M}{11}$, $\frac{M}{12}$, $\frac{M}{13}$, $\frac{M}{14}$, $\frac{M}{15}$, $\frac{M}{16}$; 73 $\frac{N}{9}$, $\frac{N}{13}$; 79 $\frac{A}{1}$, $\frac{A}{2}$, $\frac{A}{3}$, $\frac{A}{4}$, $\frac{A}{6}$, $\frac{A}{7}$, $\frac{A}{8}$]

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# CHAPTER - III

## CLIMATIC AND AGRICULTURAL INSTABILITY IN THE DISTRICT OF BURDWAN

Introduction : The improvement of the low yields from a cultivated land depends on suitable climate, fertility of the soil and other factors. Climate is the principal aspect of the physical environment affecting agriculture. The characteristics of the soil are the essential media for growth of the plant. The soil is the product of present and past climates and the vegetation has flourished on the soil. In a small degree, relief also varies with changes in climate. The relationship between climate and the characteristics and condition of the soil is of maximum importance for plant growth. One of the causes "of India's agricultural distress must be attributed to the climate of that country".[1] Variation in weather is a constant source of fluctuation in crop yields, and climate sets limits to what may be attempted, particularly, in arid lands.

The uncertainties of weather have significant impacts on agricultural strategy. It is very difficult to establish the relationship and influence of weather on production of crops. The climatic elements can be modified by man to a very small degree. The major climatic elements are rainfall, temperature, sunlight and wind. Among them rainfall is the most important

and variable phenomenon. The production and quality of crops fluctuate with the climatic variability from year to year.

The assumption, as suggested by Rao, is that "the characteristic appropriate for 'Bad weather' is called here 'Vulnerability Index'; and the characteristic appropriate for 'Good weather' as 'Response Index'. In 'Bad weather' the loss in output and that in 'Good weather' the gain in output due to weather factors is proportional to an index of quality of soils in a farm".[2]

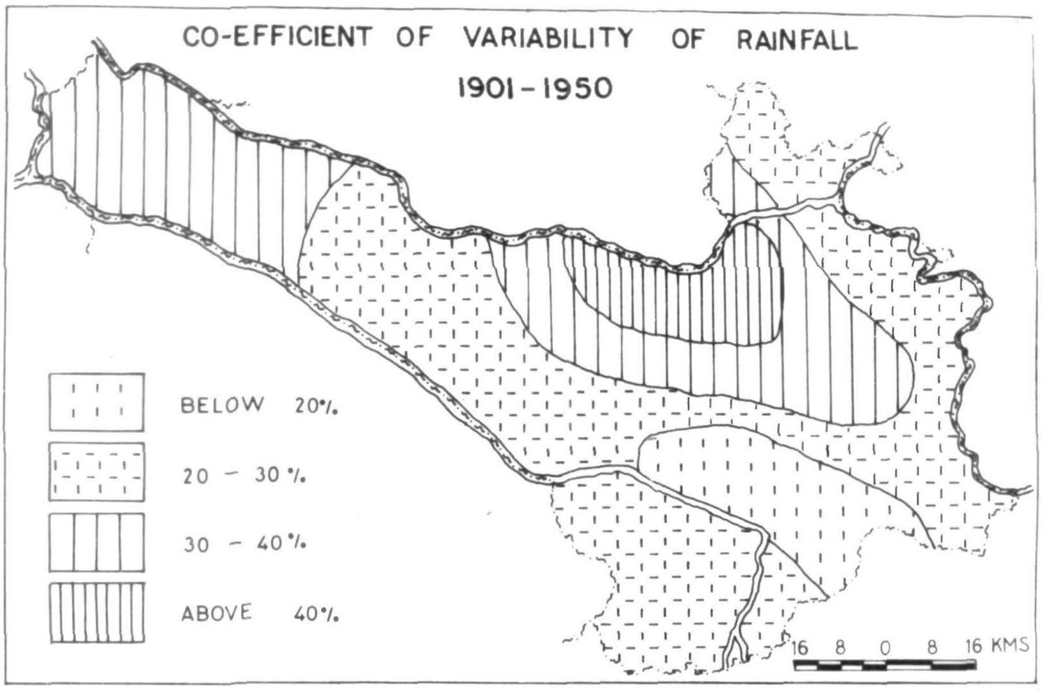
Rainfall : From agricultural point of view, rainfall is the most important climatic factor. The systems of crop production must be correlated more or less with the existing moisture conditions. Rainfall is largely concentrated from July to September. June and October are comparatively drier months and the rest of the year is relatively dry. The variability of rainfall is exceedingly high in amount, time and space in the district of Burdwan. The distribution of rainfall in the agricultural season is far more important than the quantum of annual rainfall. Agriculture makes use of water derived from the soil collected from rainfall. The climatic conditions differ in the district of Burdwan from West to East. The south east of the district is lowlying and more humid. Towards west, the land is gently undulating with a well drained laterite soil.

The uncertainty, variability and ill-distribution of rainfall sometimes obstruct the best efforts of the farmer. The production of crop depends primarily on rainfall during monsoonal period (June-September) and in winter and summer the production of crop depends on the water of canal and deep tubewell. The rainfall has "the biggest effect in determining the potential of any area, the crops which it is practicable to grow, the farming systems which can be followed and the nature timing and sequence of farming operations".[3] The Kharif crop mainly depends on the monsoon rainfall. It is quite natural that late arrival and early retreat of the monsoon seriously hampers the growth of paddy. Late arrival of monsoon delays the sowing of Kharif crops and continuation of precipitation even after the usual monsoon period damages the ripe crop. It is necessary to improve traditional rainfed farming which consists in the retention of rainfall in the soil by special tillage practices and by the construction of small embankments or ponds to intercept surface runoff. Another measure is the complete use of water flows either by retention and water level control in areas-protected with embankments or by conducting the water through channels or pipes to prepared production areas. The maximum utilization of variable rainfall should be followed through the above mentioned methods. The maximum utilization of

stored water is to provide facilities to maintain water supplies throughout the non-rainfall season.

Temperature : The climate of the western part of the district is of extreme nature both in temperature as well as humidity. There is high temperature all over the district but in the eastern side it falls rapidly at night due to availability of more water surface. During summer, hot winds known as 'Loo' blow from central India to the western part of the district. The average minimum temperature ranges from 16° to 20°C in December-January and maximum temperature varies from 33° to 38°C in April-May. High temperature remains steady till the monsoon burst.

Seasonal crops (e.g. pulses, vegetables, oilseeds etc.) are developed with relation to various seasons. Enterprise of the farmers is highly susceptible to adverse weather conditions and therefore, there is uncertainty in agricultural production. Though the total rainfall in Burdwan is sufficient in normal years, its distribution during the crop period is erratic. Therefore, in normal years artificial irrigation is a necessity to ensure a normal harvest. Owing to low rainfall and high evaporation, the area suffers from drought. Sudden rains of high intensity or prolonged duration of the


CO-EFFICIENT OF VARIABILITY OF RAINFALL
1901-1950
BELOW 20%
20 - 30 %
30 - 40 %
ABOVE 40%
16 8 0 8 16 KMS

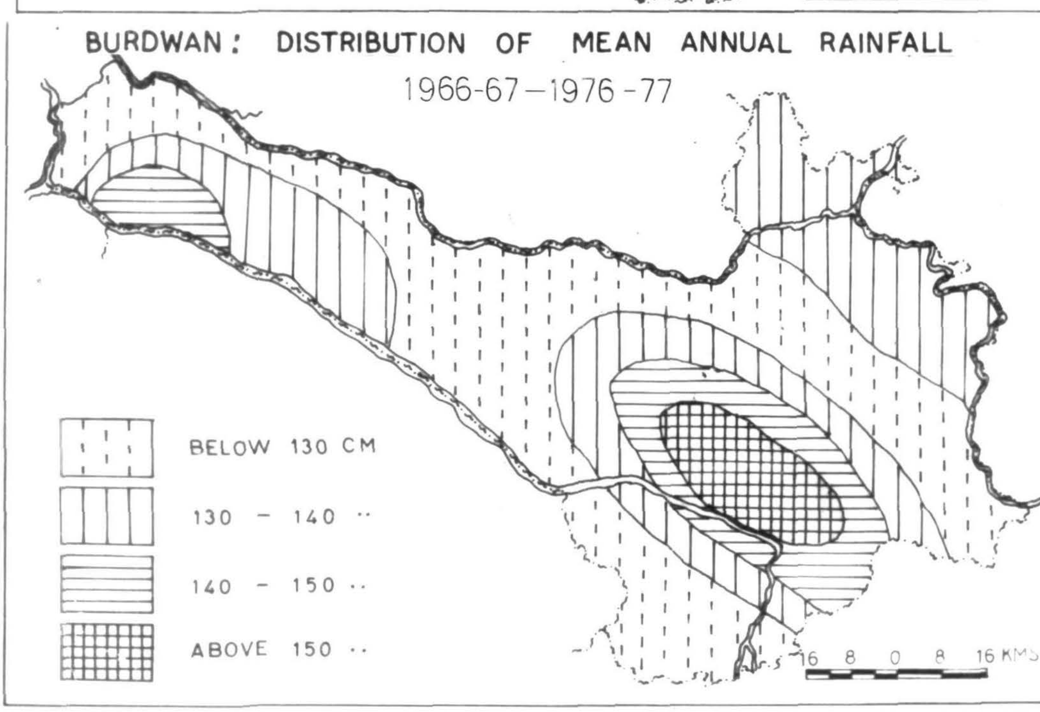

BURDWAN: DISTRIBUTION OF MEAN ANNUAL RAINFALL
1966-67—1976-77
BELOW 130 CM
130 - 140 ..
140 - 150 ..
ABOVE 150 ..
16 8 0 8 16 KMS

Fig. No. 16

same cause severe flooding as water cannot drain quickly off the land by percolation and runoff.

In figure 16 the variability of rainfall for 50 years is shown. The highest variability occurs over Mongalkote P.S. High variabilities of rainfall occur at the western and north eastern parts of the district. It will be seen from the map that there is a great variability of rainfall in the district according to space and time.

Table 1

Co-efficient of variability of rainfall during 1901-1950
(in percentage)

| | | | | | |
|---|---|---|---|---|---|
| Burdwan | - | 17.56 | Shyamsundar | - | 28.27 |
| Kalna | - | 20.67 | Asansol | - | 32.61 |
| Katwa | - | 21.30 | Monteswar | - | 39.61 |
| Mankar | - | 23.27 | Mongalkote | - | 48.36 |

[ Source : Regional Meteorological Office, Calcutta ]

Over south eastern part (Burdwan-Memari area) of the district (Fig. 16 ) the average annual rainfall is high. In the north eastern and south western parts, the mean annual rainfall is more or less medium. The rest of the district shows almost equal ranges of average annual rainfall, which varies from 120 cm to 135 cm.

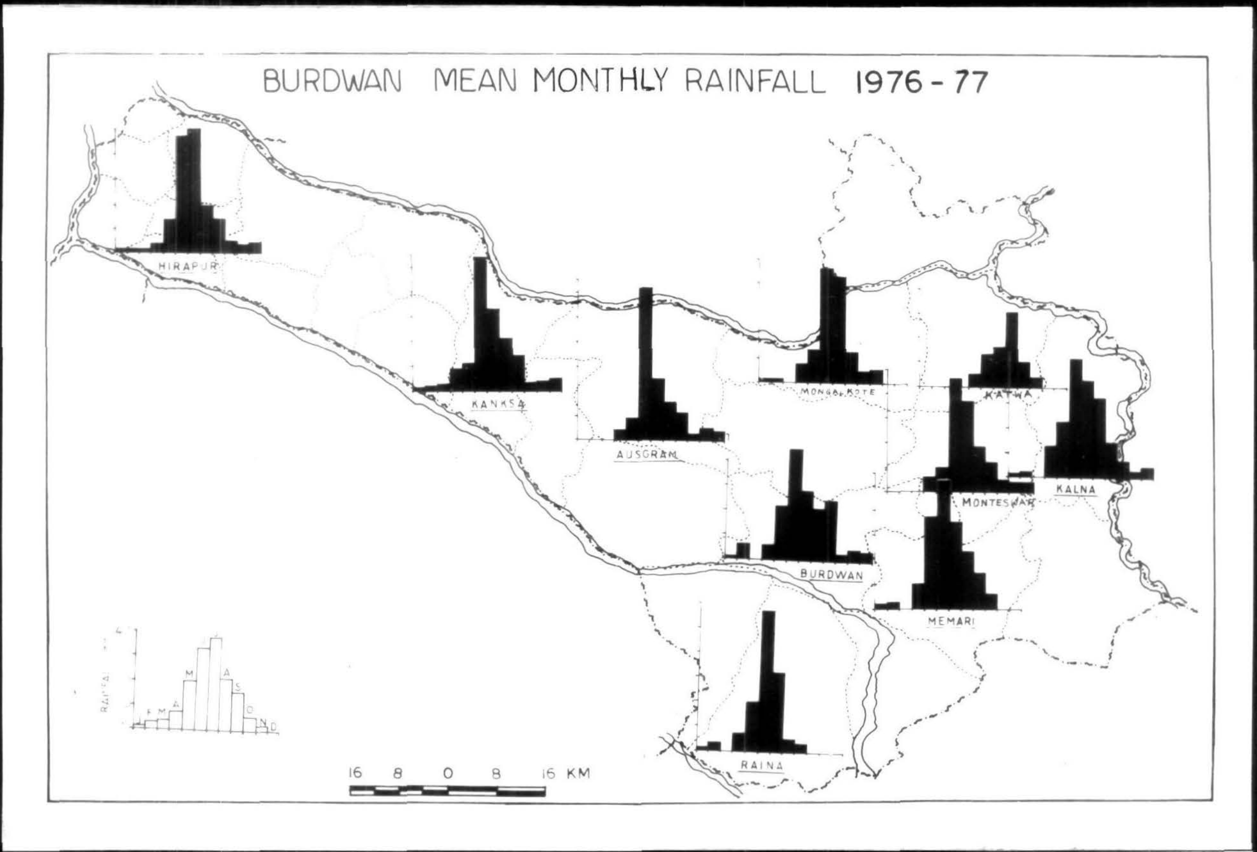

BURDWAN MEAN MONTHLY RAINFALL 1976 - 77
HIRAPUR
KANKSA
AUSGRAM
BURDWAN
KATWA
KALNA
MONTESWAR
MEMARI
RAINA
16 8 0 8 16 KM

Fig. No. 17

The Figure (Fig. 17 ) represents a comparative analysis of monthly rainfall for 10 stations for the year 1977. The map shows that there are large variations of distribution of monthly rainfall between the stations. Though the stations are situated a little apart from each other, the variation of rainfall is remarkable. Spatial variation of monthly rainfall is one of the principal factors for agricultural variability of the district.

Table 2

Monthly rainfall for 10 stations for the year 1976-77

(Rainfall in centimetre)

| | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Burdwan | 0.99 | 5.8 | - | 6.1 | 22.1 | 45.1 | 28.3 | 21.3 | 23.8 | 2.8 | 4.9 | 4.5 |
| Kanksa | 0.92 | 1.7 | 0.23 | 9.0 | 10.6 | 53.7 | 33.0 | 21.2 | 14.1 | 3.6 | 3.8 | 4.5 |
| Memari | 2.2 | 2.5 | - | 10.3 | 37.3 | 51.5 | 35.4 | 23.2 | 14.3 | 6.1 | - | - |
| Ausgram | - | - | - | 4.5 | 8.6 | 62.0 | 25.6 | 15.3 | 11.3 | 2.5 | 4.8 | 3.9 |
| Raina | 1.3 | 2.9 | - | 6.9 | 20.5 | 57.0 | 32.5 | 5.1 | 3.2 | - | - | - |
| Mangal-kote | 1.2 | 1.1 | - | 7.6 | 13.1 | 46.2 | 41.8 | 12.2 | 4.6 | 4.7 | - | - |
| Katwa | - | - | - | - | 5.2 | 12.6 | 15.8 | 29.7 | 9.9 | 4.0 | - | - |
| Purbas-thali | 0.7 | 1.7 | - | 12.5 | 22.0 | 48.3 | 39.0 | 32.2 | 13.8 | 5.7 | 2.0 | 4.2 |
| Monteswar | - | - | - | 5.9 | 10.0 | 45.8 | 37.2 | 17.8 | 12.0 | 5.3 | 3.8 | 4.1 |
| Hirapur* | 0.81 | 1.0 | 0.76 | 3.9 | 13.5 | 47.5 | 49.4 | 19.1 | 13.2 | 4.6 | 3.0 | 4.4 |

[Source : Regional Meterological Office, Calcutta]

* Burnpur Town Engineering Department, IISCO.

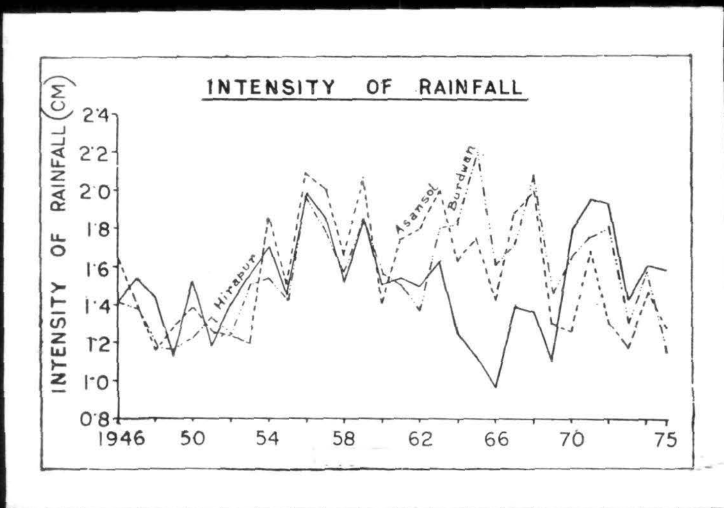

INTENSITY OF RAINFALL
INTENSITY OF RAINFALL (CM)
2·4
2·2
2·0
1·8
1·6
1·4
1·2
1·0
0·8
1946
50
54
58
62
66
70
75
Hirapur
Asansol
Burdwan

Fig. No. 18

The variation of total annual rainfall of different parts of the district are not very remarkable. "Intensity of rainfall"[4] fluctuates from year to year. The Figure (Fig. 18 ) shows the intensity of rainfall for three stations, of which Hirapur has maximum variability of intensity of rainfall. Deforestation of several areas in the district is the main factor for this variability, as there is a direct relationship between rainfall and vegetation. Another factor is the topographical variation as "the intensity of rainfall generally varies with the altitude".[5]

Table 3

Intensity of Rainfall (cm./day) $I = \frac{A}{n}$

A = Total rainfall over a given period

n = Total number of rain-days

| Year | Hirapur | Asansol | Burdwan |
|---|---|---|---|
| 1946 | 1.42 | 1.65 | 1.41 |
| 1947 | 1.54 | 1.41 | 1.38 |
| 1948 | 1.44 | 1.16 | 1.17 |
| 1949 | 1.14 | 1.28 | 1.16 |
| 1950 | 1.52 | 1.38 | 1.22 |
| 1951 | 1.18 | 1.26 | 1.33 |

Table 3 (contd.)

| Year | Hirapur | Asansol | Burdwan |
|---|---|---|---|
| 1952 | 1.39 | 1.23 | 1.24 |
| 1953 | 1.56 | 1.19 | 1.50 |
| 1954 | 1.71 | 1.86 | 1.53 |
| 1955 | 1.45 | 1.50 | 1.42 |
| 1956 | 1.98 | 2.08 | 1.97 |
| 1957 | 1.84 | 1.99 | 1.78 |
| 1958 | 1.51 | 1.63 | 1.56 |
| 1959 | 1.85 | 2.06 | 1.83 |
| 1960 | 1.50 | 1.40 | 1.57 |
| 1961 | 1.54 | 1.74 | 1.50 |
| 1962 | 1.49 | 1.79 | 1.36 |
| 1963 | 1.62 | 2.0 | 1.80 |
| 1964 | 1.24 | 1.63 | 1.81 |
| 1965 | 1.12 | 1.74 | 2.20 |
| 1966 | 0.96 | 1.42 | 1.59 |
| 1967 | 1.39 | 1.88 | 1.71 |
| 1968 | 1.37 | 2.01 | 2.07 |
| 1969 | 1.09 | 1.29 | 1.46 |
| 1970 | 1.78 | 1.26 | 1.65 |
| 1971 | 1.95 | 1.67 | 1.76 |
| 1972 | 1.93 | 1.29 | 1.80 |
| 1973 | 1.42 | 1.17 | 1.30 |
| 1974 | 1.60 | 1.47 | 1.57 |
| 1975 | 1.59 | 1.28 | 1.15 |

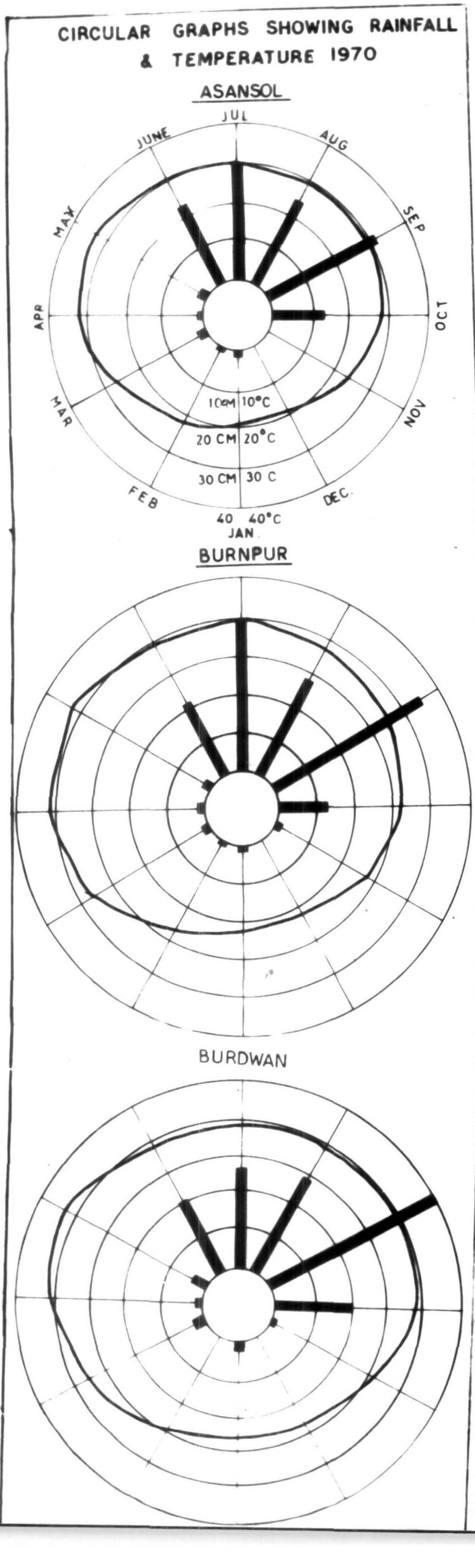



Fig. No. 19

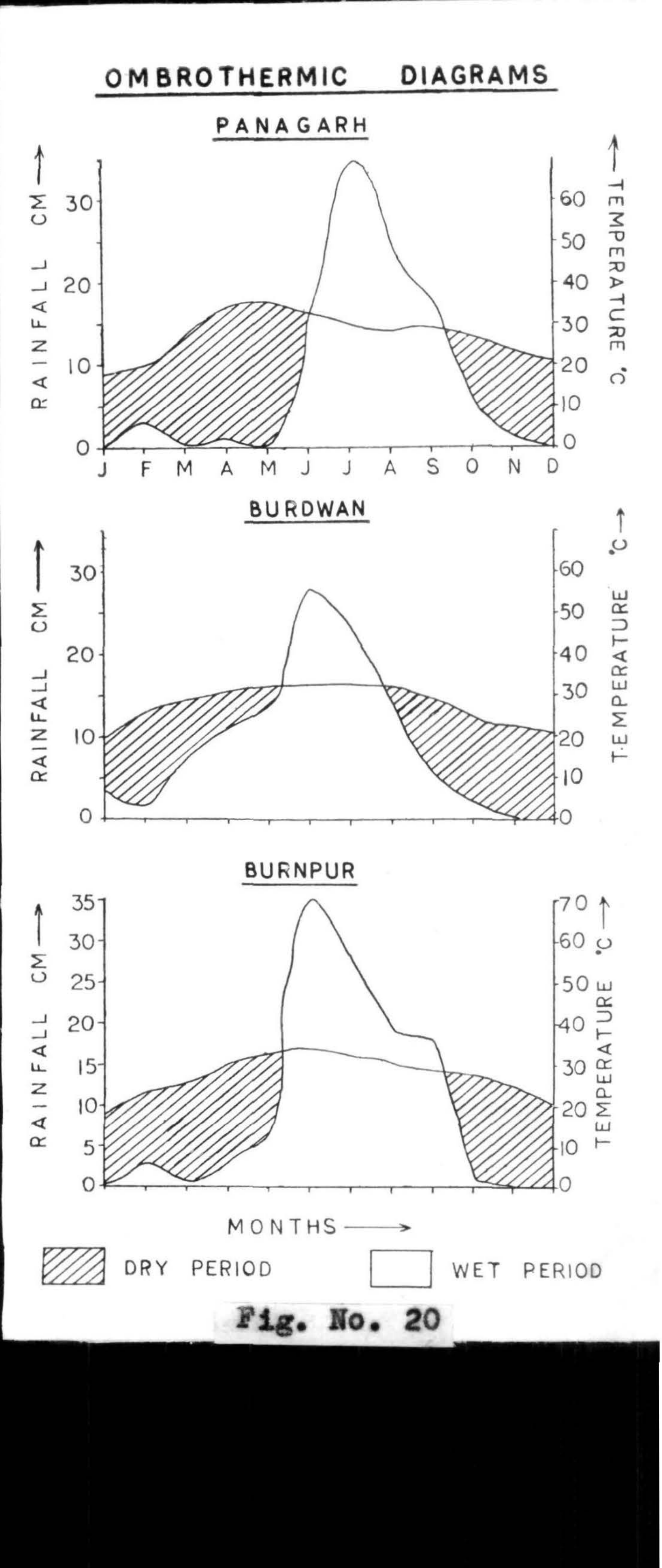



Fig. No. 20

There is high temperature from March to October and low temperature from November to February throughout the district. Three circular graphs (Fig. 19 ) of Hirapur,Asansol and Burdwan are shown here for comparative analysis of rainfall and temperature. There are little variations of monthly rainfall and temperature in Hirapur, Asansol and Burdwan. The fact that there are such differences in variabilities of the three stations within a short distance intervening between these leads to the conclusion that this variability is largely a function of relief.

The Ombrothermic Diagram (Fig. 20 ) illustrates that Burdwan is an area of more wet period than Hirapur and Asansol. Due to this longer wet period in Burdwan paddy occupies the principal position among the crops.

It is true that though paddy grows during the months of maximum rainfall, it still needs irrigation as the rainfall is variable both in quantity and distribution during the period of cultivation. The water requirements of growing paddy follow more or less a set pattern. Excessive rainfall at any time serves no useful purpose and may sometimes be actually harmful. Such uncertainties in rainfall, specially in the western part of the district, coupled with the lack of irrigation facilities have an adverse effect on agriculture.

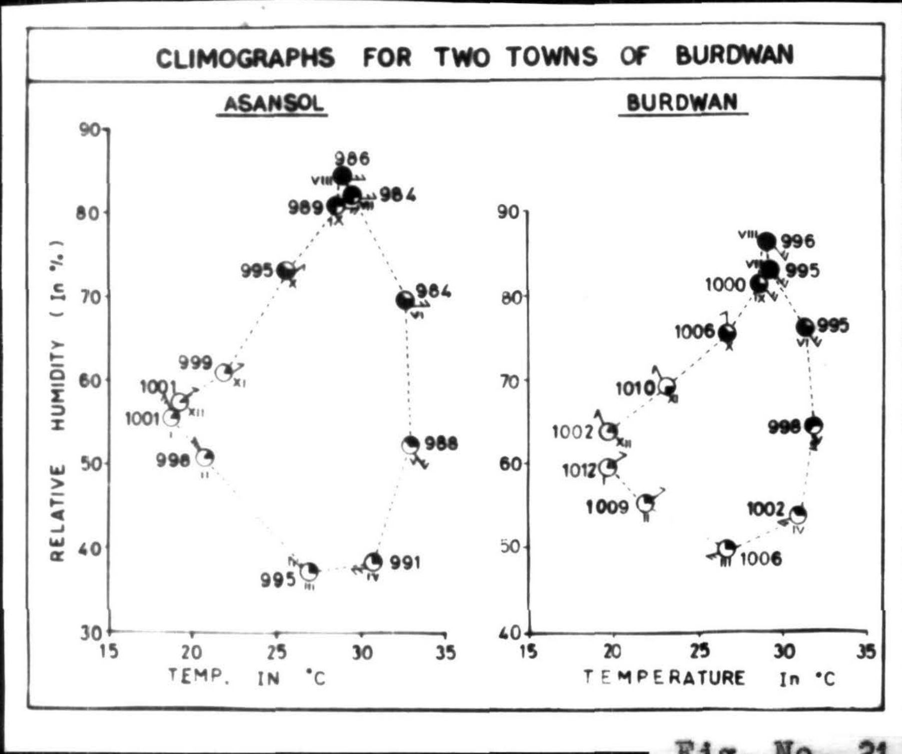



Fig. No. 21

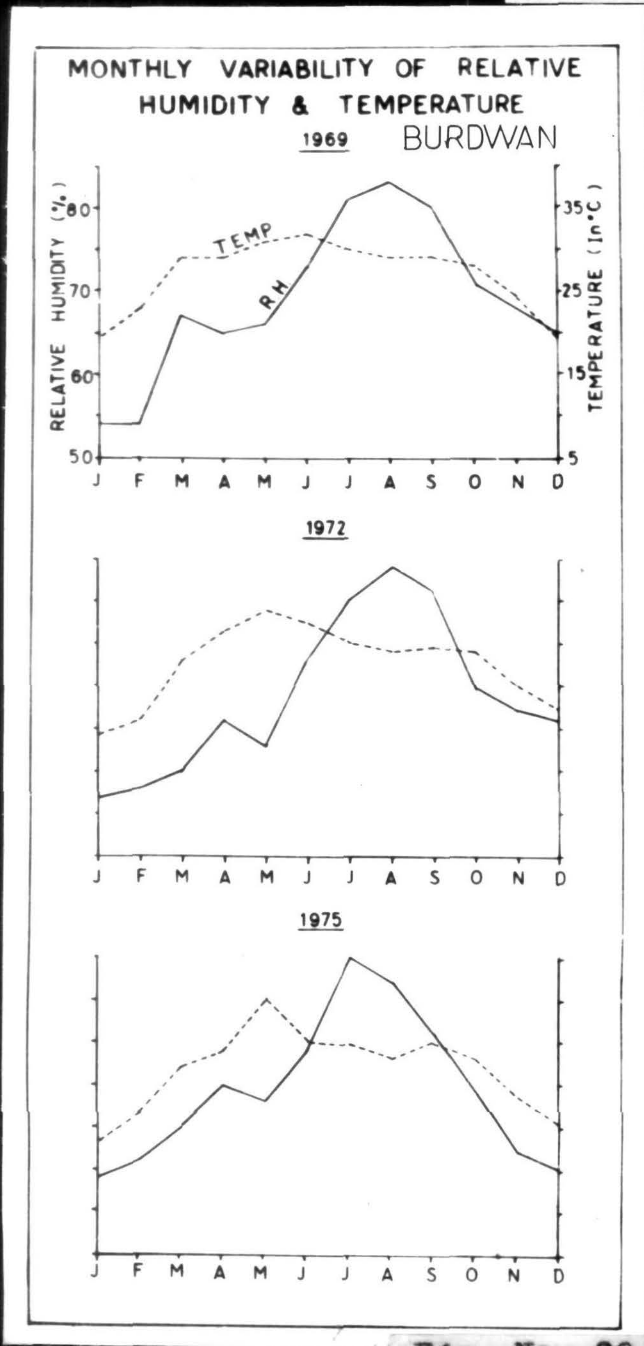



Fig. No. 22

Sunshine : Along with temperature and rainfall, sunshine is also one of the contributing factors in agriculture. The amount of sunshine, degree of sunshine and cloudiness of the sky are the regulating factors for growth of a plant. For the cultivation of crops and good yield rate, a long duration of sunshine is more important than its intensity. The district of Burdwan represents the typical climate for the cultivation of paddy and wheat. "The intensity of solar radiation increases rapidly with altitude as the amount of dust in the atmosphere decreases. Sunlight falling on bare soils can lead to water evaporation and organic matter breakdown".[6]

The climographs (Fig. 21 ) show more close pattern in Burdwan than Asansol because the highest-lowest ranges of humidity and temperature are low in Burdwan. Moreover, climograph shows the condition of cloud, pressure and wind direction of Asansol and Burdwan.

The monthwise relationship between relative humidity and temperature of Burdwan, as shown in Figure (Fig. 22 ) illustrates that relative humidity bears a direct relation with temperature. In the month of July, August and September, the relative humidity is high because of the temperature which is also high in the month of May and June.

Physical conditions of crops : Every plant requires a certain amount of water for its growth. Abundant supply of water is considered as the most important factor for production of paddy. Water is lost by evaporation, percolation and runoff from surface of the field and transpiration from plants and also due to maldistribution. An annual rainfall of 125-155 cm well distributed over the year is suitable for the growth of paddy. Paddy requires a mean monthly temperature of about 23° - 26° C during the growing season. As rainfall is heavy in the monsoonal lands the water-supply conditions suit the crop well. There are three types of paddy, Aus, Aman and Boro, which are cultivated in different seasons.

Aus : This crop is sown in May-June (Bengali Month Jaistha) after 'Kalbaishakhi rain', when the temperature remains high. The growing of crop takes place in high temperature and sufficient stagnant water. At its ripening period, bright sunny weather is necessary in the month of September-October (Ashwin-Kartick). The crop is harvested in October. The crop is usually grown mostly in areas which are submerged.

Aman : Aman crop is sown in July-August (Ashar-Sravan) when the temperature is pretty high and the cultivated lands are filled with stagnant water. The growing and ripening periods

are the same as that for Aus crop. It is harvested in November-December after ripening in bright sunny weather during October-November. The crop is generally grown both in irrigated and non-irrigated areas as it is grown during monsoon.

<u>Boro</u> : It is a winter crop and it requires irrigated water, medium temperature and bright sunny weather. It is sown in December-January (Pausha-Magha) and harvested in April (Chaitra-Baishaka). This crop is grown in the same land after harvesting of Aman or Aus. Due to non-availability of rains, irrigated water is necessary from canals, tanks and tubewells. The crop is mostly grown on low lying marshy areas where water accumulates.

<u>Wheat</u> : This crop grows well under a cool dry climate with a minimum temperature of 15° - 18°C. A cool, moist climate is preferable during the growing period. An average rainfall of 65-70 cm is considered favourable. Its growing period is the same as that of Boro paddy. It is sown in December-January and harvested in March-April. Prolonged low temperature is very necessary for the growing of wheat. Wheat requires irrigated water during sowing and growing periods. For good production of this crop, bright sunny weather, constant low temperature and irrigated water are needed,

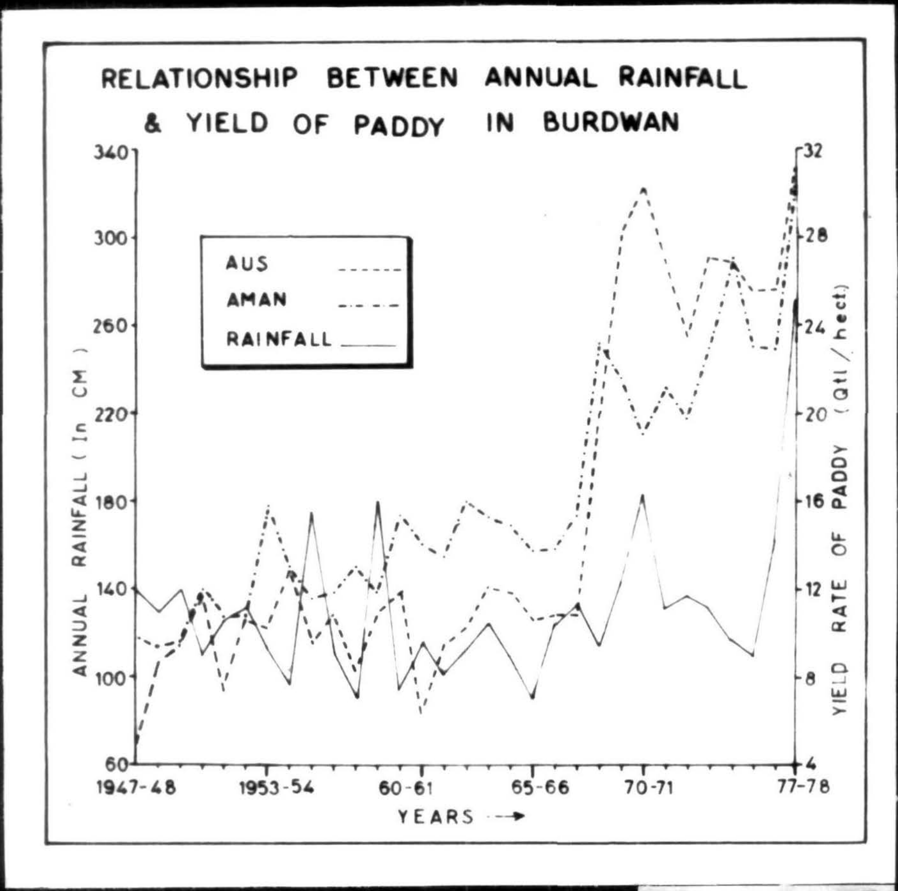

RELATIONSHIP BETWEEN ANNUAL RAINFALL
& YIELD OF PADDY IN BURDWAN
AUS
AMAN
RAINFALL
ANNUAL RAINFALL ( In CM )
YIELD RATE OF PADDY ( Qtl / hect)
340
300
260
220
180
140
100
60
32
28
24
20
16
12
8
4
1947-48
1953-54
60-61
65-66
70-71
77-78
YEARS

Fig. No. 23

and as such, winter season is the ideal period for wheat cultivation.

The requirement of water varies in different periods of the growth of the plant i.e. 30-35 per cent is required for the preparation of land, sowing and transplanting of plants; 50-55 per cent from planting upto the time of flowering, and 10-15 per cent upto the time of ripening. The water requirement varies with the duration of the crop, mechanical composition of soil, amount of soil humus and variety of crop.

An analysis of the relationship between annual rainfall and yield of paddy shows that rainfall fluctuates every year from 80 to 260 cm during 1947-48 and 1977-78. Aus and Aman paddy completely depend upon rainfall. For that reason fluctuation in the yield of the crop, takes place with the fluctuation of the amount of total rainfall. During 20 years from 1947-48 to 1967-68, yield of crop mostly depended upon amount of rainfall. After 1967-68, yield of crop increased abruptly though fluctuations were present. The yield of Aus and Aman depends upon total amount of annual rainfall (Fig. 23 ). To compensate for the irregularity of rainfall irrigation is very necessary. A number of canals for irrigation were constructed after 1950-51. At present, a

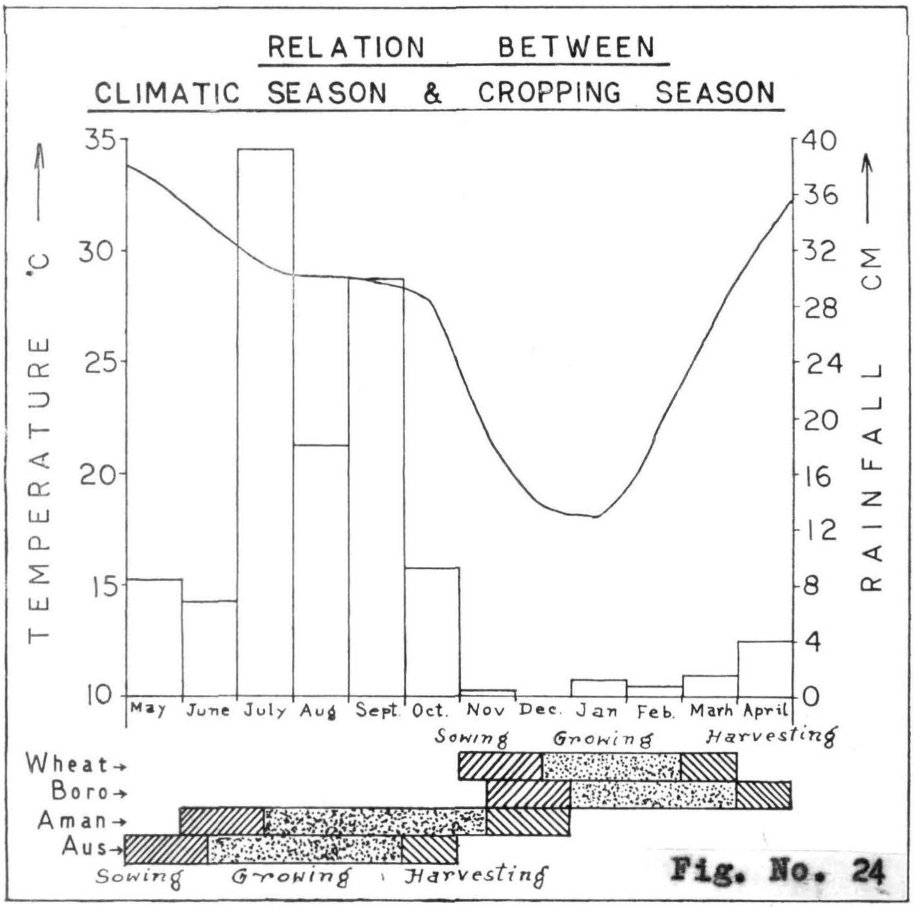

RELATION BETWEEN
CLIMATIC SEASON & CROPPING SEASON
TEMPERATURE °C
RAINFALL CM
35
30
25
20
15
10
40
36
32
28
24
20
16
12
8
4
0
May
June
July
Aug
Sept.
Oct.
Nov
Dec.
Jan
Feb.
Marh
April
Sowing
Growing
Harvesting
Wheat→
Boro→
Aman→
Aus→
Sowing
Growing
Harvesting

Fig. No. 24

large area is being cultivated from irrigational canals. But this is not adequate for the Boro and wheat crops which are solely dependent on the irrigational water in winter and cannot therefore, be cultivated in many areas. These canals are also fully dependent upon the amount of total annual rainfall. Therefore, wheat and Boro paddy are indirectly dependent upon rainfall.

The district of Burdwan presents various types of crops with its variable climate. Figure (24) shows that temperature is very high in the months of April, May and June, but rainfall is low or medium during this period. During July, August and September both rainfall and temperature are high. From October the temperature as well as rainfall gradually decreases. The months of December and January are very cold and then rainfall is minimum or nil. From March the temperature rises and amount of rainfall increases. About 200 days are required for the growing of Aman crop. More than one month of rain-free period is necessary for harvesting of Aman paddy. Boro crop requires a long period about 120 days of low temperature and sufficient irrigated water. For good yield of wheat a long spell of cold weather of about 150 days is very essential. In the harvesting time of all crops rainfall is very harmful

and bright sunny weather is necessary for less wastage of crop. Besides rice and wheat, various other crops which include pulses, sugarcane, potato and jute etc. are grown in the district. Sugarcane and jute were cultivated widely in the past, but at present these are grown only in a few areas of the eastern part of the district (e.g. Ketugram, Katwa, Kalna, Purbasthali and Rayna P.S.). The cultivation of jute is gradually decreasing because it is a "soil exhausting crop".[7] High temperature and high rainfall are suitable for jute ecology. Sugarcane is essentially a tropical crop. It requires a long humid season during the period of growth and a fairly dry cold season. The coverage of the crop is gradually decreasing due to its long growing period and for the need of a fairly dry cold season. Pulses are grown at the western part of the district because medium and comparatively high lands are suitable for the crops. Pulses are of two types - Kharif and Rabi. From their ecological consideration it is evident that these can be grown in varied conditions. Moderate temperature and rainfall suit potato. Accordingly, in central and eastern parts of the district potato cultivation takes place.

Large amounts of organic matter in the soil are produced in areas where temperature is high. Organic matter is dependent upon climatic conditions of that area. Due to

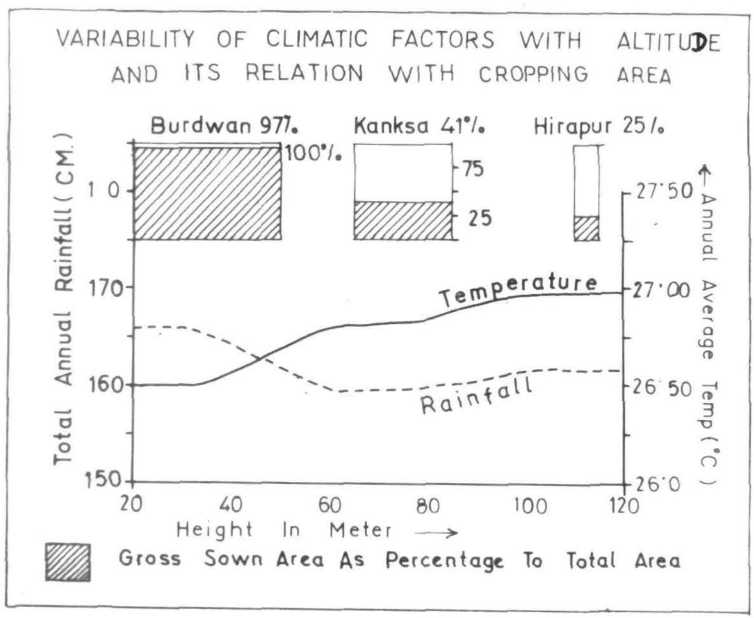

VARIABILITY OF CLIMATIC FACTORS WITH ALTITUDE
AND ITS RELATION WITH CROPPING AREA
Burdwan 97%
Kanksa 41%
Hirapur 25%
100%
75
25
Temperature
Rainfall
Total Annual Rainfall (CM.)
170
160
150
27·50
27·00
26·50
26·0
Annual Average Temp (°C)
20
40
60
80
100
120
Height In Meter
Gross Sown Area As Percentage To Total Area

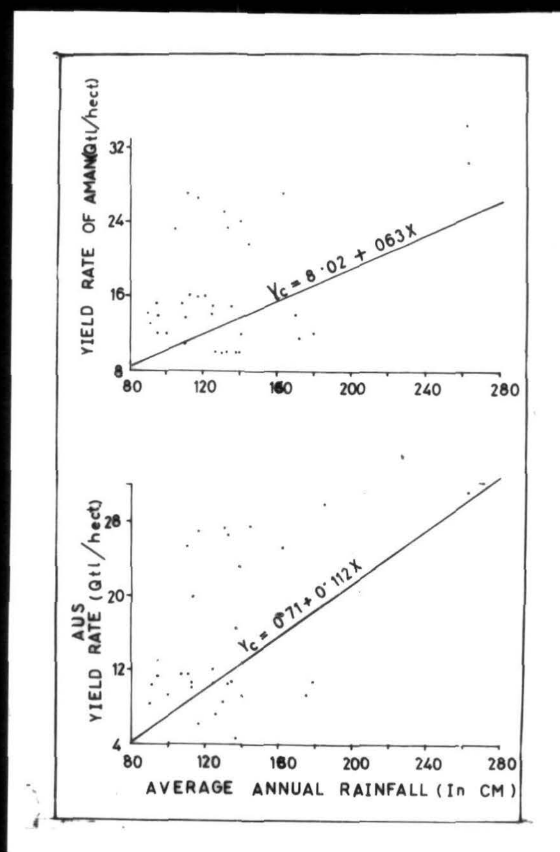
Fig. No. 25

presence of high temperature and surplus moisture in some parts of the district, the organic materials rapidly decompose when aerated. "As a consequence, such soils lose a major portion of their original organic matter shortly after they being brought under cultivation".[8]

Variability of climatic factors with altitude and its relation with cropping area (Fig.25 )

Hirapur is situated at a high elevation, (100-120 m) where annual rainfall is medium and average temperature is higher than in Burdwan and Kanksa P.S. The position of Kanksa is on a gently sloping land at an elevation of 60-70 m. The annual rainfall is lower than that of other two areas and temperature is medium. Burdwan lies on flat land (20-30 m), where temperature is the lowest and rainfall is the highest among the three stations. The figure shows the gross area under cultivation and percentage of total area in divided rectangles. The cropped area is at 97 per cent in Burdwan, 41 per cent in Kanksa and 25 per cent in Hirapur. Cultivated area in each police station depends primarily upon rainfall, temperature and topography.

It can be said that throughout the district of Burdwan climate and topography has a great deal to do with cultivation. In pre-Independence era, agriculture of Burdwan



YIELD RATE OF AMAN (Qtl/hect)
$Y_c = 8 \cdot 02 + 063X$
AUS YIELD RATE (Qtl/hect)
$Y_c = 0.71 + 0.112X$
AVERAGE ANNUAL RAINFALL (In CM)


Fig. No. 26

depended upon rainfall and the water supplied from tanks, wells, rivers etc. During that period lack of irrigation water adversely affected production of crops. The wide range in production of crops in recent years has become possible because of the availability of irrigation, fertiliser and other technological inputs. "For crop production, even distribution of rainfall over the agricultural season is far more important than the quantum of rainfall in the year".[9]

Figure indicates that there is a distant relationship between the climate and the agricultural development of the district. The rainfall variability is high, co-efficient of variability ranges from 17 to 48 per cent during 1901-50. Therefore, successful agricultural production depends on irrigation to a considerable extent. The winter season remains dry with very little rainfall, which is beneficial to Rabi crops. Summer season with heavy shower is very beneficial to Kharif crop. The method of cultivation is still very much dependent on the vagaries of nature, that is why, there are high fluctuations in productivity even in the case of modernised agriculture. Figure ( 26 ) shows the correlation between average annual rainfall and yield of Aman and Aus. In case of Aus, coefficient of correlation is 0.48 and in case of Aman, it is 0.4. The figure illustrates fairly positive degree of correlation in both the crops Aman and Aus, though

a little higher correlation exists in case of Aus than Aman. Due to the lack of rainfall in winter Boro crop and wheat are cultivated by irrigation.

"Penman of the Rothamstead Experimental Station in the U.K. even concludes that the daily water requirement of all crops would be much the same if they were grown on the same soil and for the same growing season".[10] This idea has been entertained by many irrigation specialists till now.

Conclusion : In the district, high yielding variety seeds were introduced in 1967-68, which require timely irrigation and sunshine together with inputs of various kinds. Aus and Aman variety cultivated in monsoonal period is not of high yielding type. There is lack of sunshine during monsoon period. Moreover, the district gets untimely and irregular rainfall. As a result, the yield rate fluctuates with climatic instability. That is why HYV seeds are not cultivated during monsoon period. During winter HYV is cultivated by optimum irrigation and sunshine. But all cultivated lands do not get irrigation facilities during winter. During winter the district produces high yielding Boro paddy from a limited area at the eastern and central parts of the district. Therefore, it is necessary to cultivate high yielding variety of crops of Aman, Aus and Boro in monsoon climate. The

performance of agriculture in a year depends mainly on the rainfall behaviour and the terrain condition of the locality. The agricultural production has become independent of climatic behaviour since the inception of canal irrigation. But due to inadequate and untimely irrigation facilities the crop yield is still greatly dependent on climate. It is true, that the HYV requires better and timely irrigation than the local varieties, but still it promises a better yield.

The production of crop should be stable because of the new variety seeds, though climate may be unstable. In the light of the present and foreseeable technology, the district will never have sufficient water to completely satisfy the plant needs. It will continue to be a limiting factor of crop production. Therefore, it is essential that future supplies of water be used in a more efficient manner. The new variety of crops should be planted in the district, which should have better adaptability for our climatic and terrain conditions.

The ground water reserves should be improved and supplied timely for utilization in periods of drought and also in the western part of the district. There should be provision of water cisterns for collecting rainfall and supplying as supplementary irrigation to cushion rainfall

deficiencies. "For conjunctive use of surface and ground water and for a judicious exploitation of the ground water resources, geological, hydrological and geohydrological studies of the tract should be made".[11] The measures should be taken against flood damage to agricultural production in the eastern part of the district through channelization for rapid water removal or diversion of flood water into uncultivable zones or into artificial storage from which water later may be released during subsequent dry seasons.

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Burnpur Town Engineering Department, IISCO.
District Census Handbook, Burdwan, 1971.
IADP, Agricultural Office, Burdwan.

## CHAPTER - IV

## SOILS AND THEIR CHARACTERISTICS AND INFLUENCE ON AGRICULTURE

Introduction : Soil plays a very significant role in the development of economic condition of a region. Soil formation follows a fairly definite pattern according to the topography of the District of Burdwan. It is necessary to characterise the soil for agricultural planning. One soil can be distinguished from another according to the variations in the nature of horizons in soil profiles.

Production of crops is considerably influenced by soil conditions in the district of Burdwan. Fertility of soil seems to exert significant control on the spatial distribution of cultivated land and spatial differences in the intensity of agricultural activities in Burdwan. This fertility of soil is controlled by several other factors, i.e. topography, drainage pattern and climate. Though fertility is the most important soil factor for agricultural production, it is maintained and raised by application of chemical and organic fertilisers. In the case of fertility of soil, 'the law of diminishing return' has begun to act over the district.

Factors of soil production : The soil of Burdwan is the product of five soil forming factors. "Jenny's soil

forming factor, $S = F(cl, b, r, p, t)$"[1] is applicable in this area.

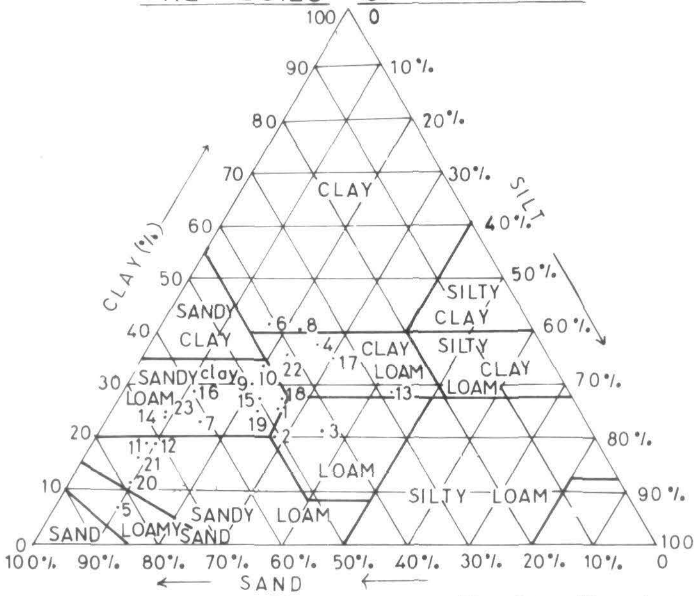
In the district of Burdwan, temperature and rainfall are the direct and indirect factors of soil formation. Rainfall affects profile development through erosion, producing thin lateritic soils on steep slopes at the western part and deposition of alluvium soil on flat land at the eastern part of the district. Vegetation exerts its main influence on soil formation through the amount and nature of organic matter it adds to the soil and also aids in the control of erosion. Different types of soils (e.g. lateritic and alluvium soil) may be developed from similar parent material under various topographical and hydrological conditions. A longer time is required for soil development starting from the bed rocks, then from the parent material and a pretty long period is needed for the development of soil profile in the district. Soil characteristics in a place result from the combined influence of climate and living matter,acting upon the parent rock material, as conditioned by relief over periods of time, including the effects of the cultural environments and man's use of the soil.

<u>Description of soil</u> : The soils of Burdwan district differ from those of central Bengal, both physically, chemically and in geological origin. The western portion consists of

lateritic and laterite soils and red soils. The abundant area of eastern portion consists of Vindhya alluvium and Gangetic alluvium. The whole of the western part of the district is formed from the debris of the hills of Manbhum, Singhbhum and Santhal Parganas and also formed directly from the subjacent rock more or less altered by the action of disintegrating agencies such as atmosphere and water. The greater portion of the eastern tract consists of materials transported by hill-fed streams (e.g. Ajay, Damodar) and formed Vindhya alluvium soil. The remaining portion of the eastern tract consists of materials transported and deposited by the Bhagirathi and formed Gangetic alluvium soil. Thus the silt deposited lands are known as "diara land", which is very fertile and most suitable for production of crops. The area covered with clay is reddish due to the presence of iron. The alluvium area consists of old alluvium and new deltaic alluvium.

The soil of extreme north western part is developed on Archaean gneisses and granites at an elevation of over 150 m above sea level. High summer temperature and monsoon rainfall of this part enhance rapid weathering as well as chemical activities, such as hydrolysis and oxidation, thus leading to laterisation and latosolisation. The lateritic soil of the western part is very hard and is occasionally exposed to the surface. Intensive irrigation and manuring is necessary for cultivating the soil.

## THE TEXTURAL CLASSIFICATION OF THE SOILS OF BURDWAN




SANDY CLAY LOAM ..... 1 KHANDAGHOSH 9 KATWA 10 BHATAR
18 KETUGRAM 15 PURBASTHALI 23 ANDAL
19 MONGALKOTE 14 BARABANI 7 JAMURIA
16 HIRAPUR

SANDY LOAM ..... 11 SALANPUR 21 FARIDPUR 20 KANKSA
12 MEMARI

LOAMY SAND ..... 5 JAMALPUR

CLAY LOAM ..... 4 MANTESWAR 13 KALNA 17 AUSGRAM
22 KULTI

CLAY ..... 6 RAINA 8 RANIGANJ

LOAM ..... 2 BURDWAN 3 GALSI

Source: Guide For Textural Classification By The United States System

Fig. No. 27

The soils of the eastern part are compact and hard when dry but turns into a mass of tenacious clay when wet. These soils belong to the group of low terrace soils and are moderately coarse textured. The water holding capacity of the soil is below the normal requirements of the cultivated crops. Due to low lying situation, such soils need effective drainage system for the safe disposal of excess water either through overflow or by the accumulation during monsoon.

Soil Texture : According to textural classification the soils of the district can be classified into several types such as, sandy clay loam, clay loam, sandy loam, loamy sand, loam and clay. Major part of the district shows sandy clay loam soil, containing a high percentage of sand and a little of silt and clay.

The textural condition of soil can be measured by the "Triangular Diagram"[2] (Fig. 27 ). This diagram shows that Jamalpur P.S. contains high sand percentages of loamy sandy soils. Due to silt deposition of the Damodar, the P.S. also suffers from inundation. P.S. Burdwan and Galsi show loam textural soil, which contains medium quantity of sand, silt and clay most suitable for crop production. Raniganj and Rayna P.S. show clay soil with high clay content. This soil is very hard when dry, and sticky when wet. In Kalna, Monteswar, Ausgram and Kulti, there is clay loam soil which

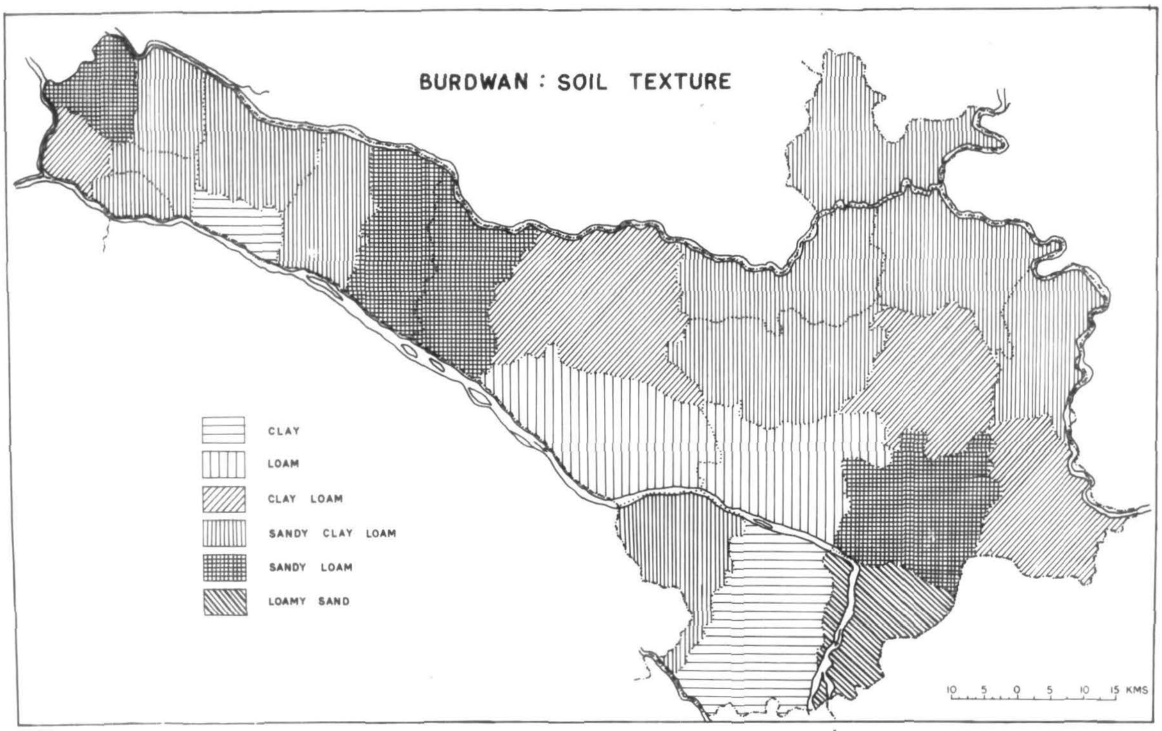

BURDWAN : SOIL TEXTURE
CLAY
LOAM
CLAY LOAM
SANDY CLAY LOAM
SANDY LOAM
LOAMY SAND
10 5 0 5 10 15 KMS

Fig. No. 28

also contains medium quantity of sand, silt and clay. This soil has very high productivity. Memari, Kanksa, Faridpur and Salanpur present sandy loam soil, comprising of higher quantity of sand, medium quantity of silt and a little clay.

The soil textural map (Fig. 28 ) also shows the textural soil classification according to different police stations in the district.

Soils with high percentages of sand and low percentages of clay are frequently low in fertility and water holding capacity and a poor source of plant nutrients. In this district, near the river bed, the sandy materials are usually deposited where the water moves more slowly. This type of soil is present in the P.S.Burdwan, Galsi, Monteswar, Kalna, Ausgram, Rayna and Raniganj. In Kulti, Faridpur, Salanpur, Kanksa, Barabani, the finer materials are removed and the coarser remain deposited. The sandy soils do not hold enough water and they represent a poor storehouse for plant nutrients whereas clay soils hold more water and have the capacity to attract nutrients.

Sprinkler systems of irrigation may be applied to the sandy soils and so also organic matter whereupon the capacity of sands to hold water and plant nutrients may improve. For the study of the soils of the district, it is necessary to analyse the surface and genetic study of all the major composition of soil.

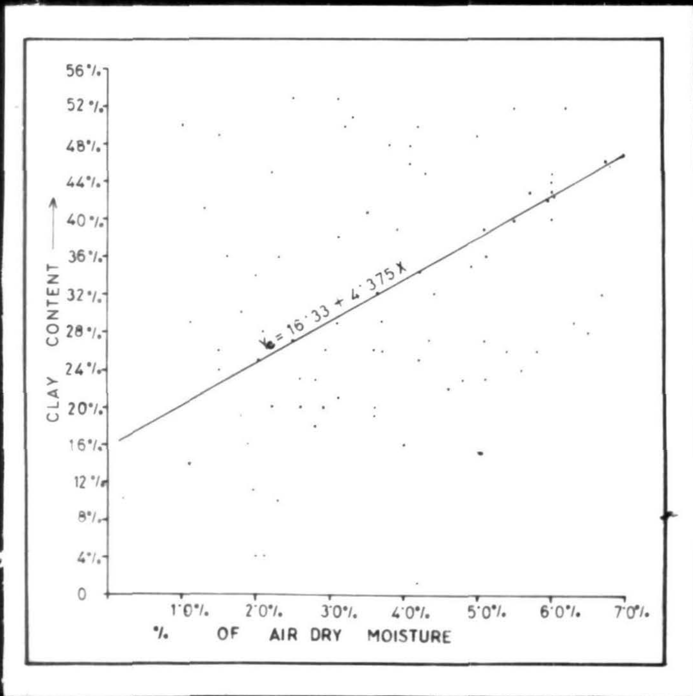



Fig. No. 29

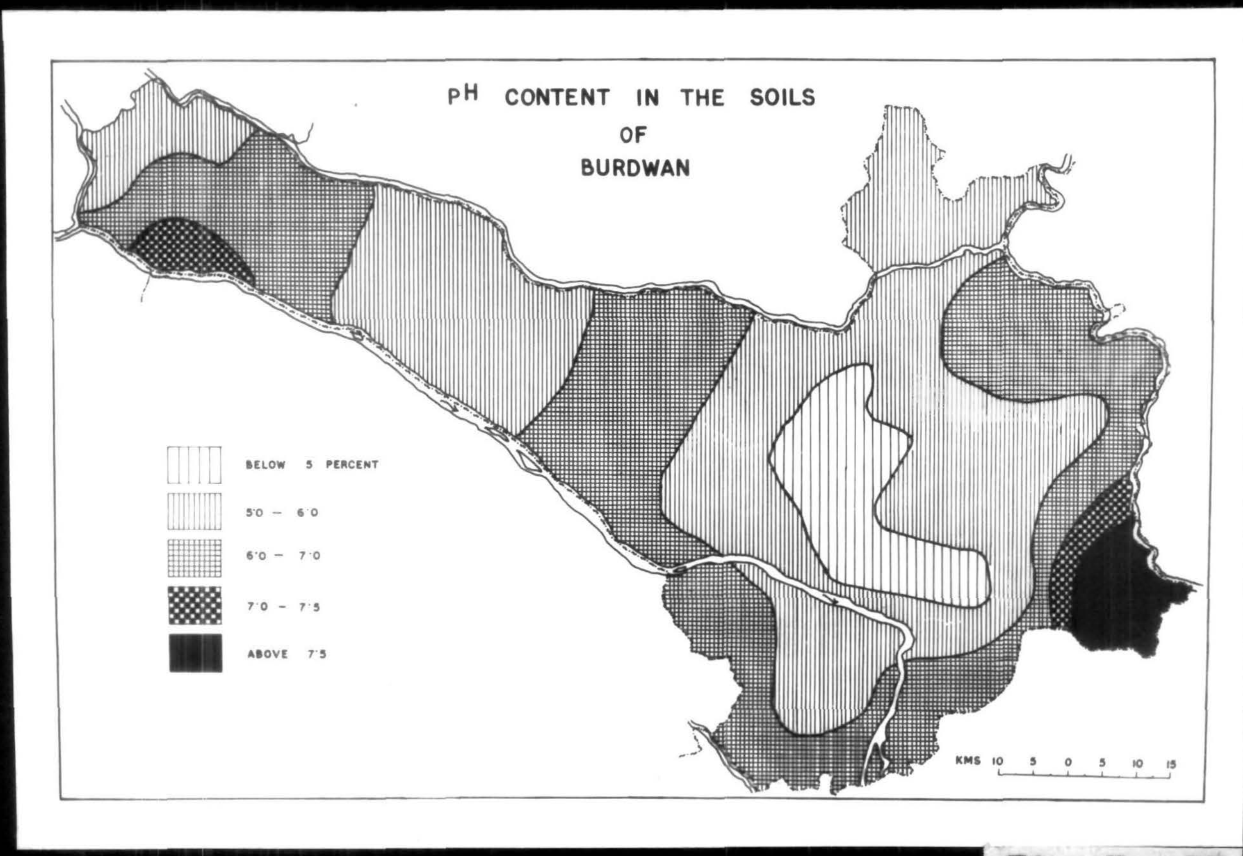



Fig. No. 30

<u>Airdry moisture</u> : The Figure (No. 29 ) illustrates the correlationship between air dry moisture and clay. There is a close relationship between the two variables. A positive medium degree correlation indicates that clay content increases with moisture content in the soil. In eastern parts of the district, the percentage of clay is higher in the soil because there is high content of water in it. These clay soils are soft when wet and very hard when dry. In the district moisture content varies from 1.0 - 7.0 per cent and clay content from 4 - 55 per cent. The correlation co-efficient is 0.934 and the regression equation is $Y_c = 16.33 + 4.375\ X$.

<u>Chemical composition of soil</u> : Chemical properties of a soil control not only genesis but also productivity. The main sources of chemical composition are (1) parent material, (2) atmosphere, (3) water, (4) vegetation etc. The numerous chemical transformations occur in the solid, liquid and gaseous phases, colloidal and crystalloidal system, mineral and organic substances which are present in the soils of the district constitute its chemical properties.

<u>pH</u> : pH is the most important chemical property of the soil. In the District (Fig. No. 30 ) pH varies from 4.5 - 5.0. Kalna shows high pH value (7.7) i.e. very slightly alkaline. Hirapur also shows more or less neutral to very slightly alkaline (7.4). At the centre of the eastern part, the soils

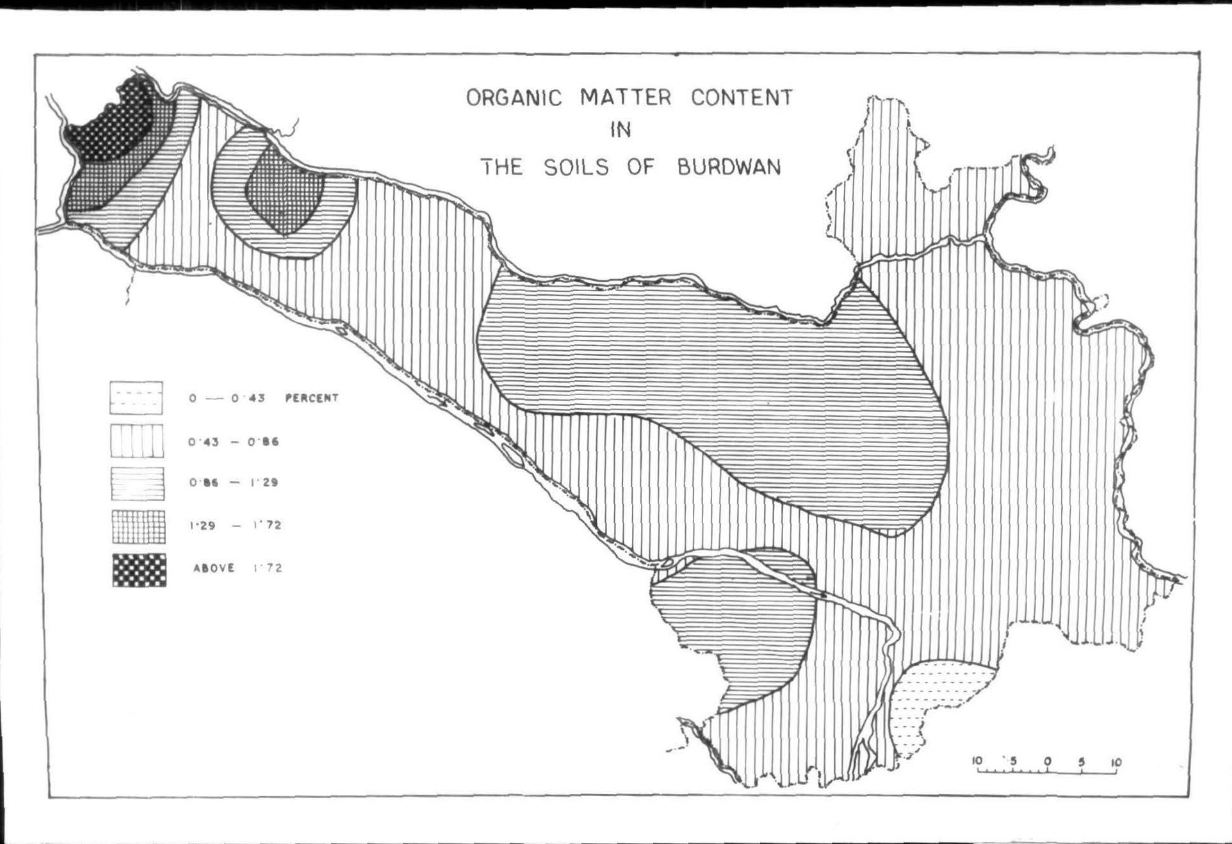



Fig. No. 31

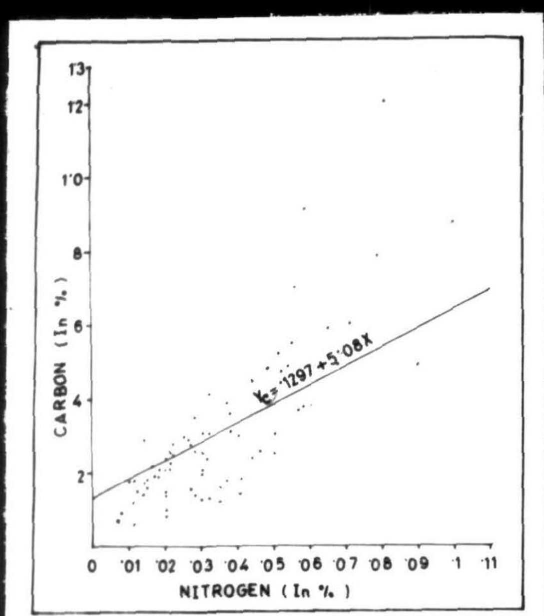



Fig. No. 32

are acidic (pH 4.5 - 5.0). Slightly acidic soil (pH 5.0 - 6.0) exists at the extreme northwestern part, P.S. Kanksa, Faridpur, Andal and at a vast area of the eastern tract. Very slightly acidic to neutral soils are present to some extent in the western part, central part and at the border of the eastern boundary. The decomposition of humus under forest cover results in slight acidity of this soil. In the western side, owing to high rainfall and steep slope, the soil is much affected by leaching and the base exchange capacity is low. The pH of the soil depends mainly on the amount and nature of clay and the organic matter content. In central and north western part the soils are slightly acidic due to occurrence of forests.

<u>Organic matter</u> : The carbon distribution map (Fig. 31 ) shows that the highest amount of organic matter is present at Salanpur P.S. since the crop rotation is not practised continuously there. It may be said that continuous crop rotation deteriorates the soil organic matter. Lowest organic carbon is present in patches at the south eastern part of the district, where the rivers slowly wash away the organic matter content present at the surface of the soil. Carbon content is very low all over the district. The natural organic matter is very low. Moreover wind and water erosion moderately affects it over the area. On account of high

temperature and rainfall in the district, weathering and leaching action take place, as a result of which the organic matter of the surface soil decomposes and is washed out. Two small patches of higher organic matter content are present at the western side, where a little forest cover is present. Organic matter also increases the water holding capacity of the soil.

The figure of Carbon-Nitrogen relationship (Fig. No. 32) explains that there is high degree positive correlation. Over the whole district, nitrogen and carbon contents are very low and they are directly related. "Jenny and Roy Choudhury (1960) conclude that the low level of organic matter in many soils primarily caused by environment and only secondarily by cultural practices".[3] In this case the correlation co-efficient is (r) 0.858 and the regression equation is $Y_c = 0.1297 + 5.08\ X$.

Table - 1

| | Percentages of Carbon | Percentages of Nitrogen | C : N |
|---|---|---|---|
| 1. Khandaghosh | 0.59 | 0.065 | 9.07 |
| 2. Burdwan | 0.47 | 0.052 | 9.04 |
| 3. Galsi | 0.38 | 0.58 | 6.55 |
| 4. Monteswar | 0.44 | 0.64 | 6.87 |
| 5. Jamalpur | 0.24 | 0.02 | 12.00 |
| 6. Rayna | 0.49 | 0.09 | 5.44 |
| 7. Jamuria | 0.97 | 0.109 | 9.90 |
| 8. Raniganj | 0.26 | 0.03 | 8.67 |
| 9. Katwa | 0.31 | 0.032 | 9.69 |
| 0. Bhatar | 0.705 | 0.056 | 12.59 |
| 1. Salanpur | 1.20 | .081 | 14.81 |
| 2. Memari | 0.45 | .044 | 9.07 |
| 3. Kalna | 0.49 | .054 | 9.07 |
| 4. Barabani | 0.39 | .037 | 10.54 |
| 5. Purbasthali | 0.31 | .050 | 6.2 |
| 6. Hirapur | 0.36 | .057 | 6.31 |
| 7. Ausgram | 0.60 | .071 | 8.45 |
| 8. Ketugram | 0.49 | .048 | 10.21 |
| 9. Mongalkote | 0.551 | .055 | 10.02 |
| 20. Kanksa | 0.52 | .051 | 10.19 |
| 21. Faridpur | 0.35 | .028 | 12.5 |
| 22. Kulti | 0.78 | .079 | 9.87 |
| 23. Andal | 0.31 | .03 | 10.33 |

Source : Soil and Landuse Survey
Indian Council of Agricultural Research,
Regional Centre, Calcutta.

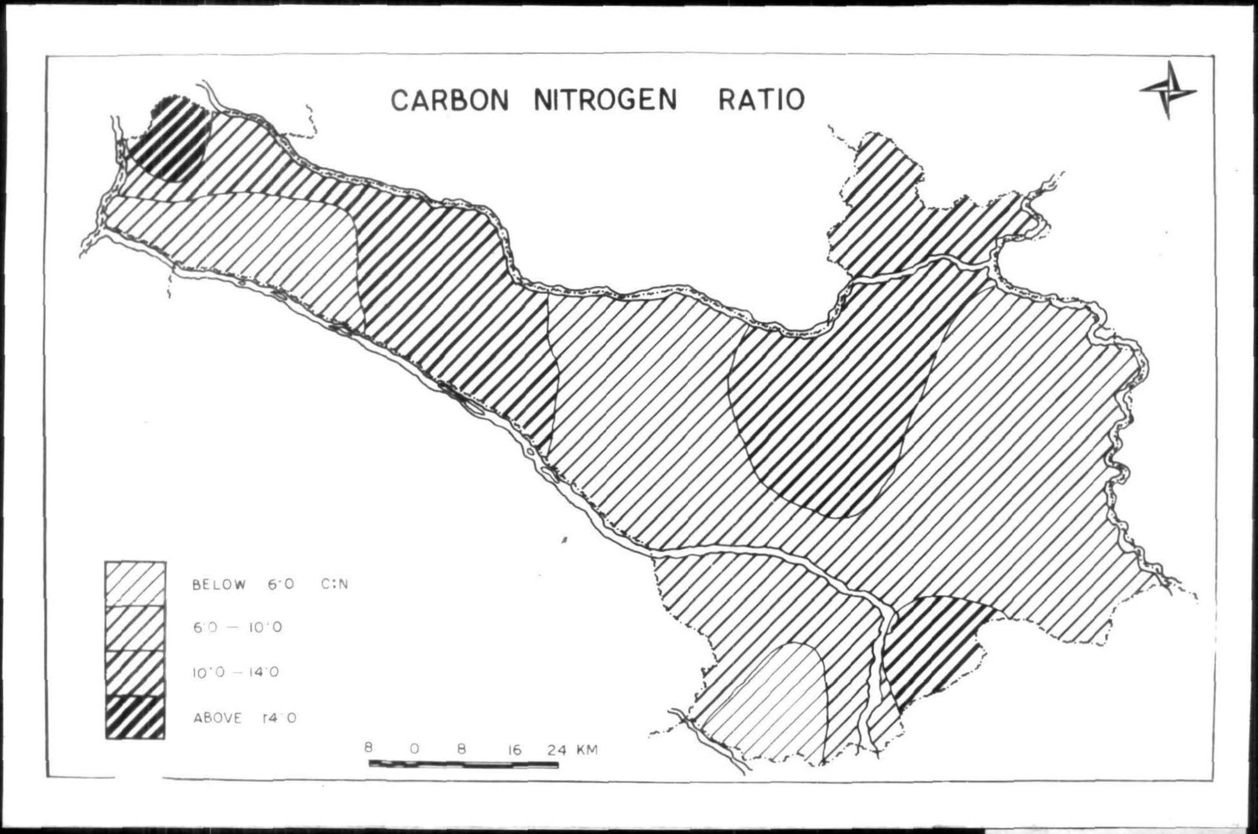

CARBON NITROGEN RATIO
BELOW 6·0 C:N
6·0 — 10·0
10·0 — 14·0
ABOVE 14·0
8 0 8 16 24 KM

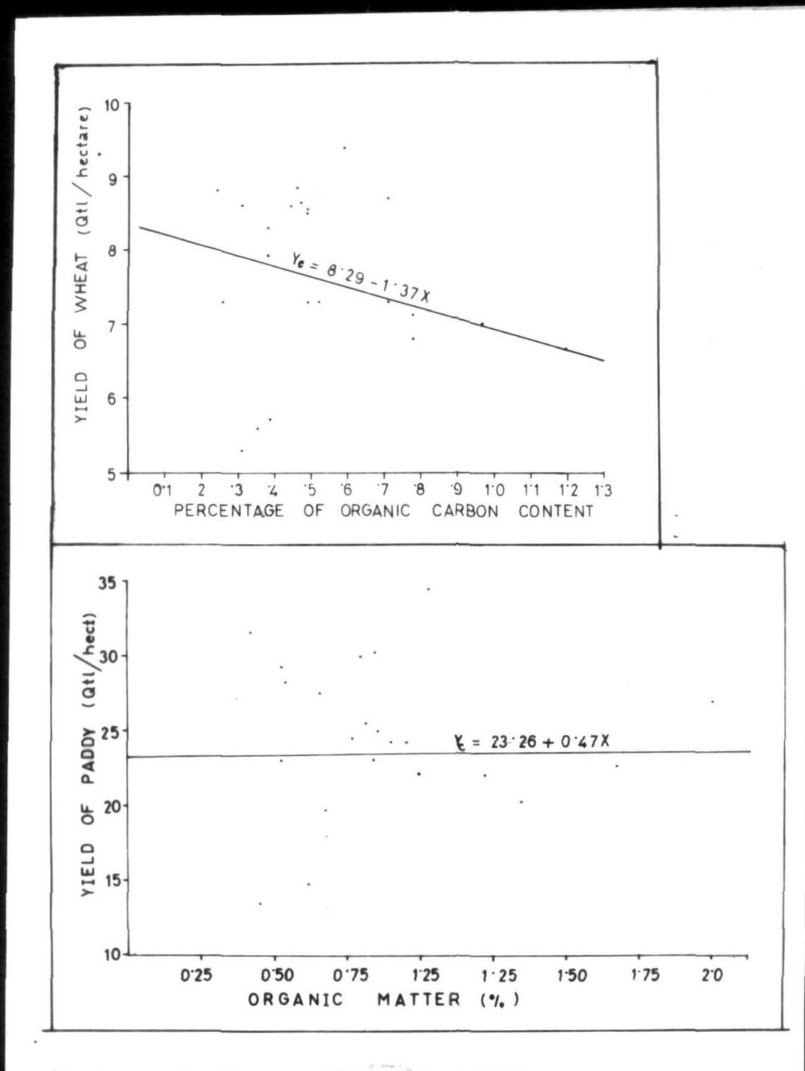
Fig. No. 33

Carbon to Nitrogen ratio of organic matter is shown in the Map (Fig. No. 33 ). Salanpur, Bhatar, Jamalpur and Faridpur show a wide ratio of carbon to nitrogen. As a consequence of wide C : N the process of decomposition appears to be accelerated. The extra nitrogen is used by the micro-organisms, more carbon is assimilated along with the nitrogen and more carbon is oxidised in the respiration process of population and released as carbon dioxide. Part of the carbon is reassimilated and part is oxidised as carbon dioxide. The process continues with loss of carbon as $Co_2$ and the C : N ratio becomes narrower. Galsi, Monteswar, Rayna, Purbasthali and Hirapur show a narrow ratio of carbon to nitrogen. The rest of the police stations show medium ratio of carbon to nitrogen. The material with a high content of nitrogen is decomposed at a more rapid rate than the material of low nitrogen content. The decomposition takes place much more rapidly where carbon to nitrogen ratios are narrow giving up more available nitrogen. As a general rule, the more thorough the decomposition, the narrower is the ratio. Nitrogen manuring should be applied where carbon-nitrogen ratio is very narrow.

Table 2

| | Carbon content X 1.724 Percentages of Organic matter | Yield of paddy (in Qtl.hectare) |
|---|---|---|
| 1. Khandaghosh | 1.02 | 34.67 |
| 2. Burdwan | 0.81 | 25.49 |
| 3. Galsi | 0.65 | 27.53 |
| 4. Monteswar | 0.76 | 24.38 |
| 5. Jamalpur | 0.41 | 31.67 |
| 6. Rayna | 0.84 | 23.08 |
| 7. Jamuria | 1.67 | 22.81 |
| 8. Raniganj | 0.45 | 13.62 |
| 9. Katwa | 0.53 | 29.23 |
| 10. Bhatar | 1.22 | 21.98 |
| 11. Salanpur | 2.07 | 27.04 |
| 12. Memari | 0.78 | 29.94 |
| 13. Kalna | 0.84 | 30.17 |
| 14. Barabani | 0.67 | 19.76 |
| 15. Purbasthali | 0.53 | 28.18 |
| 16. Hirapur | 0.62 | 14.72 |
| 17. Ausgram | 1.03 | 21.95 |
| 18. Ketugram | 0.84 | 25.01 |
| 19. Mangalkote | 0.95 | 24.23 |
| 20. Kanksa | 0.90 | 24.28 |
| 21. Faridpur | 0.60 | 19.98 |
| 22. Kulti | 1.34 | 20.29 |
| 23. Andal | 0.53 | 23.05 |

$$Y_c = 23.26 + 0.47 X.$$



YIELD OF WHEAT (Qtl/hectare)
Ye = 8·29 - 1·37X
PERCENTAGE OF ORGANIC CARBON CONTENT
YIELD OF PADDY (Qtl/hect)
Yc = 23·26 + 0·47X
ORGANIC MATTER (%)


Fig. No. 34

The Figure (Fig. No.34 ) shows the correlation between percentage of organic matter and yield of paddy. High yield of paddy cannot be correlated with organic matter content of the soil in this district because organic manure and chemical fertilizers are applied in the soil for growing the fertility status of the soil as and where necessary. There is very low positive correlation between organic matter content and yield of paddy.

Table 2

| | | Percentages of Carbon content | Yield of Wheat (Qtl./hect.) |
|---|---|---|---|
| 1. | Khandaghosh | 0.59 | 9.39 |
| 2. | Burdwan | 0.47 | 8.65 |
| 3. | Galsi | 0.38 | 8.30 |
| 4. | Monteswar | 0.44 | 8.61 |
| 5. | Jamalpur | 0.24 | 8.81 |
| 6. | Rayna | 0.49 | 8.48 |
| 7. | Jamuria | 0.97 | 6.97 |
| 8. | Raniganj | 0.26 | 7.30 |
| 9. | Katwa | 0.31 | 7.43 |
| 10. | Bhatar | 0.71 | 8.69 |
| 11. | Salanpur | 1.20 | 5.05 |
| 12. | Memari | 0.45 | 8.84 |
| 13. | Kalna | 0.49 | 8.52 |
| 14. | Barabani | 0.39 | 5.66 |
| 15. | Purbasthali | 0.31 | 8.60 |
| 16. | Hirapur | 0.36 | 5.62 |
| 17. | Ausgram | 0.60 | 7.85 |
| 18. | Ketugram | 0.49 | 7.34 |
| 19. | Mongolkote | 0.55 | 7.94 |
| 20. | Kanksa | 0.52 | 7.29 |
| 21. | Faridpur | 0.35 | 7.28 |
| 22. | Kulti | 0.78 | 6.77 |
| 23. | Andal | 0.31 | 5.31 |

$Y_c = 8.29 - 1.37\ X.$

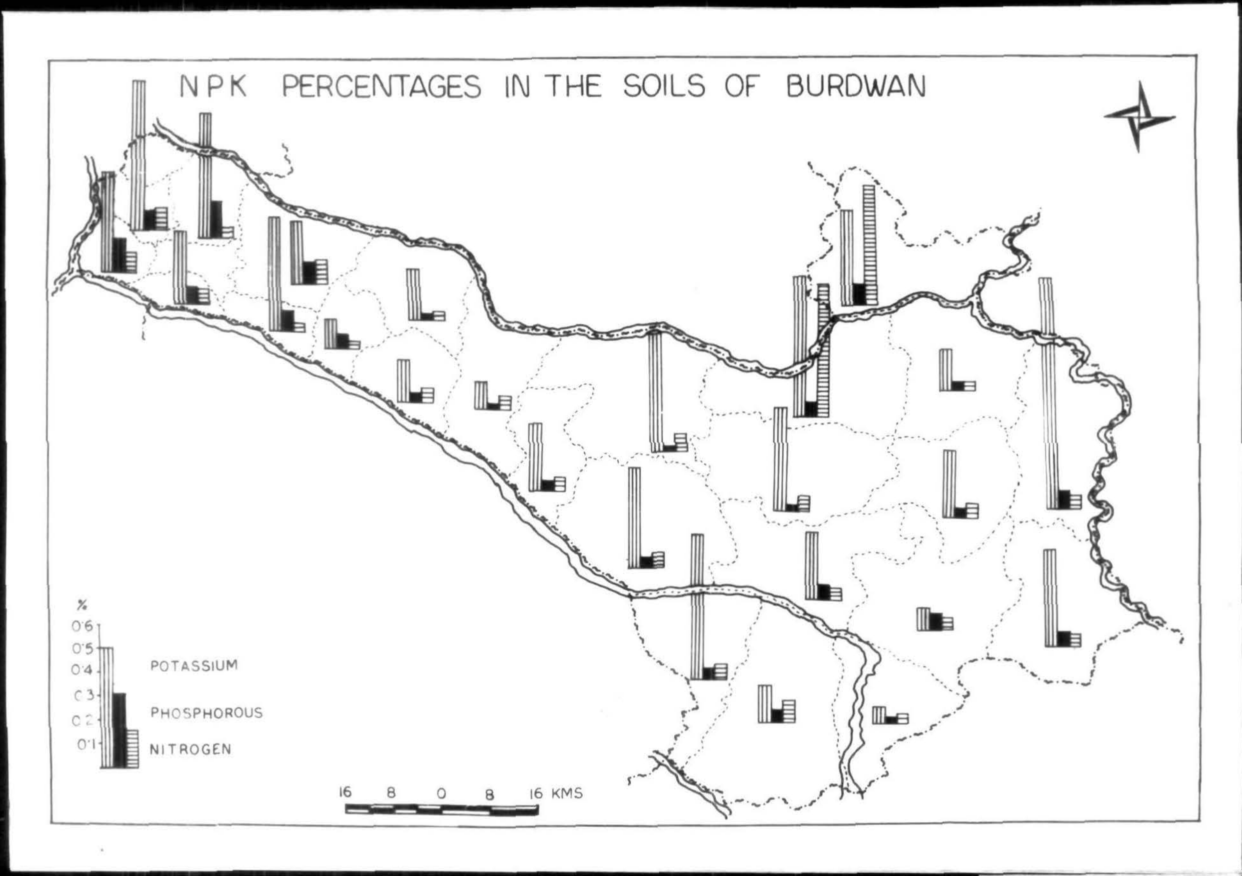



Fig. No. 35

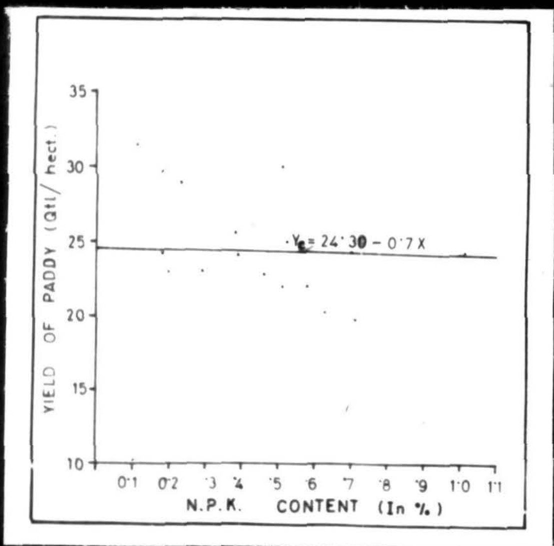



Fig. No. 36

"Walkley and Black method"[4] (Fig. No. 34 ) shows the correlation between carbon content and yield of wheat. The figure illustrates that there is negative, medium degree correlation between the variables. Carbon content is low and yield of wheat is high, but there is no correlation between carbon content of the soil and yield of wheat in the district.

"In a permanent experiment conducted at Rothamstead Experimental Station it was revealed that organic manures, besides supplying the nutrients to the crops, increased the fertility status of the soil while inorganic fertilisers deteriorated the fertility status. After the experiment continued for one hundred years, nitrogen percentage of the soil of the organic manure treated plots was doubled while that of the soils in inorganic manure treated plots was halved".[5]

<u>Nitrogen, Phosphorus and Potassium</u> - The map (Fig. No. 35 ) shows the nitrogen, phosphorus and potash contents by histogram on each police station. From the map a comparative analysis of NPK can be done. In a general way nitrogen content is higher than phosphorus and potash. Ketugram and Mongalkote shows high potash contents. Barabani and Kulti show high phosphorus content in the soil. In the rest

of the police stations there exist very low phosphorus and potash contents. Purbasthali presents highest nitrogen content. The soils of Mongalkote, Khandaghosh, Salanpur and Barabani content high amount of nitrogen. Other regions have low nitrogen content in the surface soil. From the point of view of combined NPK contents, the central part of the district is comparatively less fertile, though much of the soil nutrients and most valuable top soil are being lost due to wind and running water. Nitrogen is a very essential nutrient for crop production, but little quantity is retained in the soil of the district. Nitrogen contents are partly decomposed by micro-organisms and party leached away by water.

For maximum production, crop plants require greater amounts of nutrients than what is contained in the soil solution at any one time. There may be any kind of nutrients deficiency in soil and such deficiency also varies with the application of chemical fertilisers. Ammonium sulphates, urea, potassium nitrate fertilisers may be applied, where the soil requires nitrogen fertilisers. Superphosphate, potash and 'Sufala' may be applied where the soil suffers from phosphorus and potassium deficiency. It has been observed that the requirements of a particular kind of

fertiliser cannot be same in each year. Therefore, it is necessary to analyse the soil characteristics before the sowing of each crop for application of suitable fertiliser.

The soils are not very fertile. Soil fertility is dependent upon its inherent physical, chemical and biological properties. The best results are obtained by combined application of organic manures and chemical fertilisers. Inorganic fertiliser is efficient nutrient supply to the crop, but on a long term basis organic manure is essential for stabilisation of soil fertility status.

Greenmanuring contributes appreciably towards improving the carbon and nitrogen levels in soil. Due to artificial addition of nitrogen fertilizers, the nitrogen content is to some extent high all over the district. The rainfall and temperature conditions are partly responsible for the nutrient contents in the district,as fixation of nitrogen is controlled by plant and precipitation. "The depth, structure, texture, water holding capacity, organic matter content and available plant contents determine fertility in so far as the soil proper is concerned. But climatological factors, such asinsolation, maximum, minimum and low critical temperatures, rainfall, humidity and wind currents etc. are also important either directly as in the case of insolation and winds, or indirectly through their effects on the soil factors as in the case of rainfall".[6]

Table - 4

| | | Percentage of Nitrogen + Phosphorus +Potash (NPK) content | Yield rate of Paddy (in Quintal/Hectare |
|---|---|---|---|
| 1. | Khandaghosh | 0.715 | 34.67 |
| 2. | Burdwan | 0.387 | 25.49 |
| 3. | Galsi | 0.106 | 27.53 |
| 4. | Manteswar | 0.388 | 24.38 |
| 5. | Jamalpur | 0.11 | 31.67 |
| 6. | Rayna | 0.29 | 23.08 |
| 7. | Jamuria | 0.461 | 22.81 |
| 8. | Raniganj | 0.584 | 13.62 |
| 9. | Katwa | 0.235 | 29.23 |
| 10. | Bhatar | 0.510 | 21.98 |
| 11. | Salanpur | 0.776 | 27.04 |
| 12. | Memari | 0.183 | 29.94 |
| 13. | Kalna | 0.514 | 30.17 |
| 14. | Barabani | 0.712 | 19.76 |
| 15. | Purbasthali | 1.074 | 28.18 |
| 16. | Hirapur | 0.428 | 14.72 |
| 17. | Ausgram | 0.581 | 21.95 |
| 18. | Ketugram | 0.521 | 25.01 |
| 19. | Mongolkote | 0.700 | 24.23 |
| 20. | Kanksa | 0.175 | 24.28 |
| 21. | Faridpur | 0.261 | 19.98 |
| 22. | Kulti | 0.633 | 20.29 |
| 23. | Andal | 0.202 | 23.05 |

$$Y_c = 24.39 - 0.7\ X.$$

The Figure (No. 36 ) illustrates that there is a verynlow negative correlation between total nutrient (nitrogen, phosphorus and potassium) content and yield of paddy. The natural fertility of soil is medium in the district. Artificial fertilisers are applied to the soil every year for increasing the productivity of soil. But continuous cropping practices deteriorates the fertility. Moreover, plant nutrients are washed away by water down the gradient from the western part to the eastern part of the district. Production and yield of paddy is high in the area due to the natural fertility of the soil.

Nitrogen fertilizer increases the cation exchange capacity of plant roots and thus makes them more efficient in absorbing other nutrient ions. Phosphorus increases disease resistance in plants, presumably due to normal cell development and consequent vigorous growth. Potassium helps to produce strong and stiff straw in cereals, specially in rice and wheat.

During early period the area of forest was large, as a result of which plant nutrient and humus content were high over the district. The forest cover had been cleared for increasing the area under cultivation and industrialisation. Due to sloping land from west to east the nutrients from the surface soil are removed and washed away by wind and water.

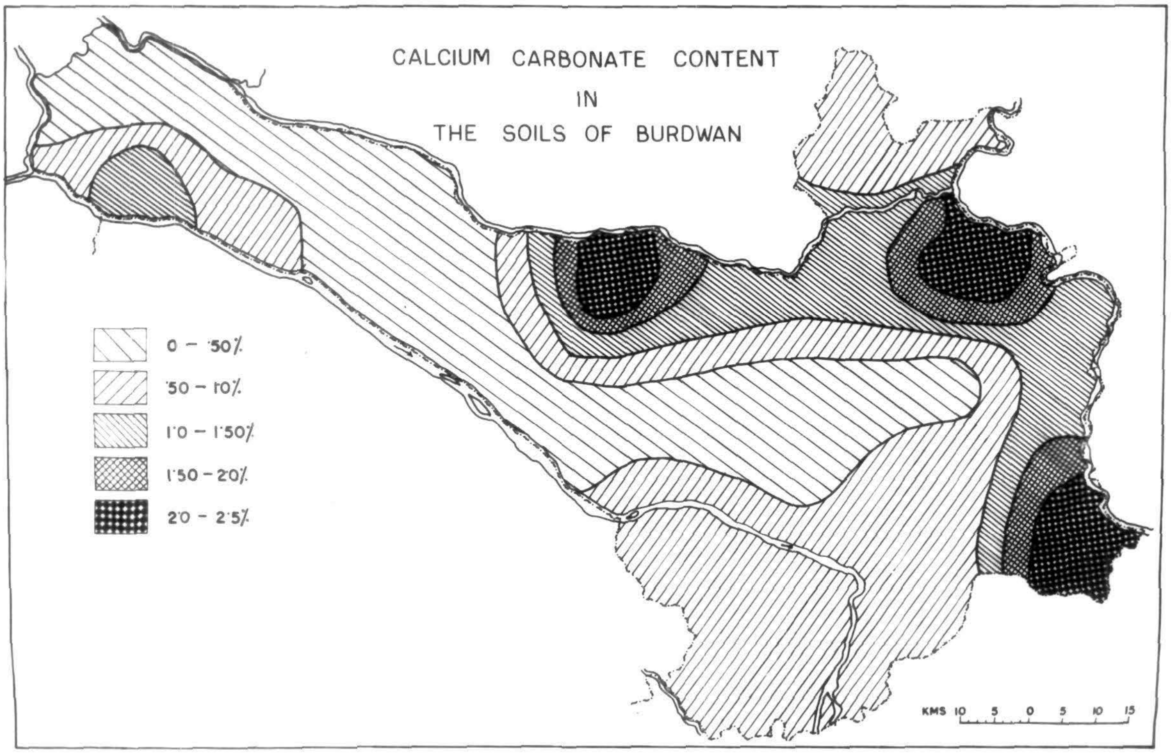



Fig. No. 37

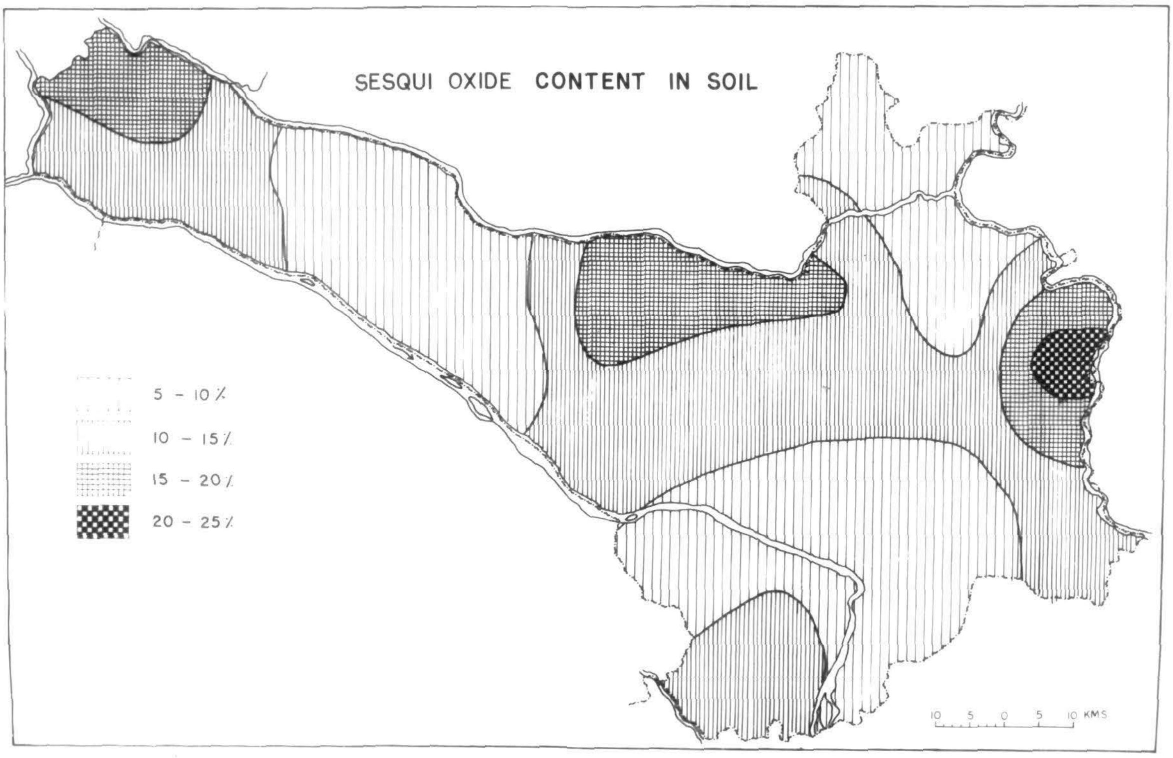
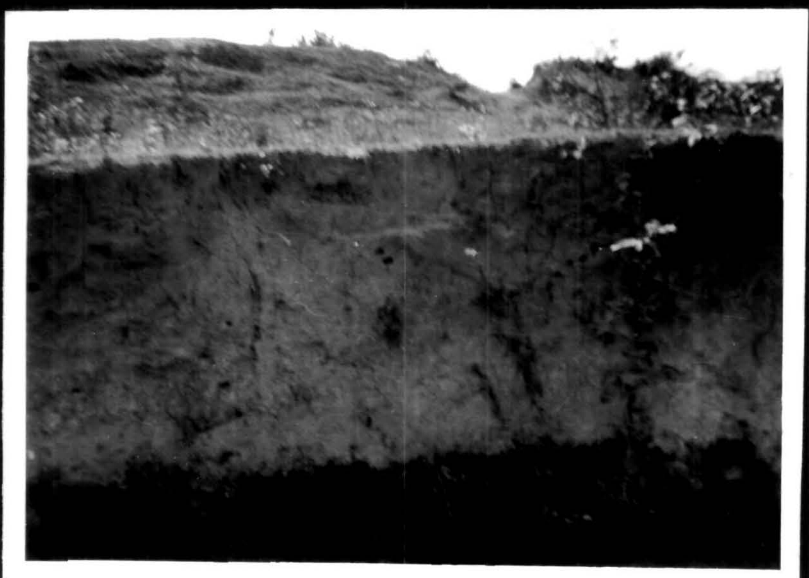



Fig. No. 38

Calcium : From the Map (Fig. No. 37 ), it is evident that there are low lime content areas, in patches, at the eastern and central parts. Small patches of calcium rich soils are present at the flood plain area of the Bhagirathi and the Ajay. Due to low lime content, the acidity of the soils persists. For removing this acidity, artificial lime or calcium carbonate should be added.

Sesquioxide : Sesquioxide is a compound of Ferrous Oxide ($Fe_2O_3$) and Al~~l~~uminium Oxide ($Al_2O_3$). The map (Fig. No. 38 ) shows that more or less high contents of sesquioxides ($R_2O_3$) are present in the soil. Ferrous Oxide and Al~~l~~uminium Oxide are high in the soil of this district. The highest content of sesquioxide is observed at the eastern corner of Purbasthali. Low percentage of this oxide is found in a small area of central part, north eastern part and south eastern part. Due to high content of sesquioxide, the colour of the soil becomes brownish and reddish. High rainfall washes out the organic matter, thus resulting in the concentration of Ferrous Al~~l~~uminium in the soil. This process leads to the formation of deeply weathered lateritic soils. Laterite and lateritic soils are characterised by compact to vasicular rock composed of a mixture of hydrated oxides of iron and al~~l~~uminium. The soil of the district contains a little amount of humus, nitrogen, phosphorus, potash and calcium due to leaching



Laterisation of soil profile in Jamuria-Raniganj area.

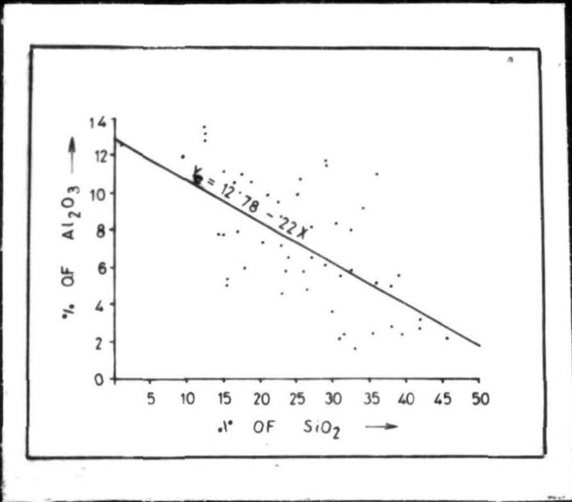



Fig. No. 39.

Gully erosion and formation of bad lands due to aeolian and fluvial action near Jamuria P.S.

and erosion. The western part of the district exhibits this type of lateritic soil, but the eastern part shows deltaic riverine type of alluvial soil. This alluvial soil is formed by silt deposition carried by the rivers Damodar, Ajay and Bhagirathi, it being a more modified fertile soil than the soil of the western part.

<u>Silica and Allumina</u> : The Figure (Fig. No. 39 ) representing allumina plotted against silica contents, produces a straight line medium degree regression of negative exponential form. This line suggests that there is to some extent laterisation throughout the profiles. There are high degrees of laterization in the western part gradually diminishing to the eastern part of the district.

<u>Soil erosion</u> : In the district of Burdwan, soil erosion by wind and water is moderate, but it is frequent due to an undulating topography and variation in climatic condition. The erosion reduces the soil nutrients from the surface. "The erosion depletes the soil of fertility by washing away the valuable mineral food of the plants and increases the silt run-off of the rivers, and brings in the decay of river regime, flooding, water logging and subsequent evils. It is mainly due to concentrated heavy rainfall, slope and unplanned land management in the river basins".[7] The soil erosion

is more pronounced over the western part covering, Durgapur-Asansol sub-division. The Burdwan sub-division shows comparatively less soil erosion. Therefore effective measures may be taken for keeping the land under permanent vegetation to prevent the soil from the erosion by wind and water (sheet and rill erosion). Due to erosion, according to slope, the materials are deposited in the river bed and over the eastern flat land. The river beds, shallowed by the deposition of eroded materials create condition for widespread flood and water logging. By dredging, the deposited materials can be removed from the river bed.

Study of the soil profiles.

The soil profile is the manifestation of all the changes, growth and development of soil body. The layers resulting from soil forming process are grouped into A-horizon, surface layer, i.e. zone of maximum leaching and erosion, B-horizon i.e. zone of deposition and C-horizon or parent material, noticeably less weathered horizon. The A and B horizons are derived from the C-horizon. The soil profile representing the result of all soil forming processes is the natural unit of study. Therefore, in comparing soils for the purpose of classification, it is necessary to consider not merely the surface soil, but all the horizons of the soil which constitute the profile. A soil profile may be

# A STUDY OF SOIL PROFILES
## IN
## DIFFERENT POLICE STATIONS OF BURDWAN

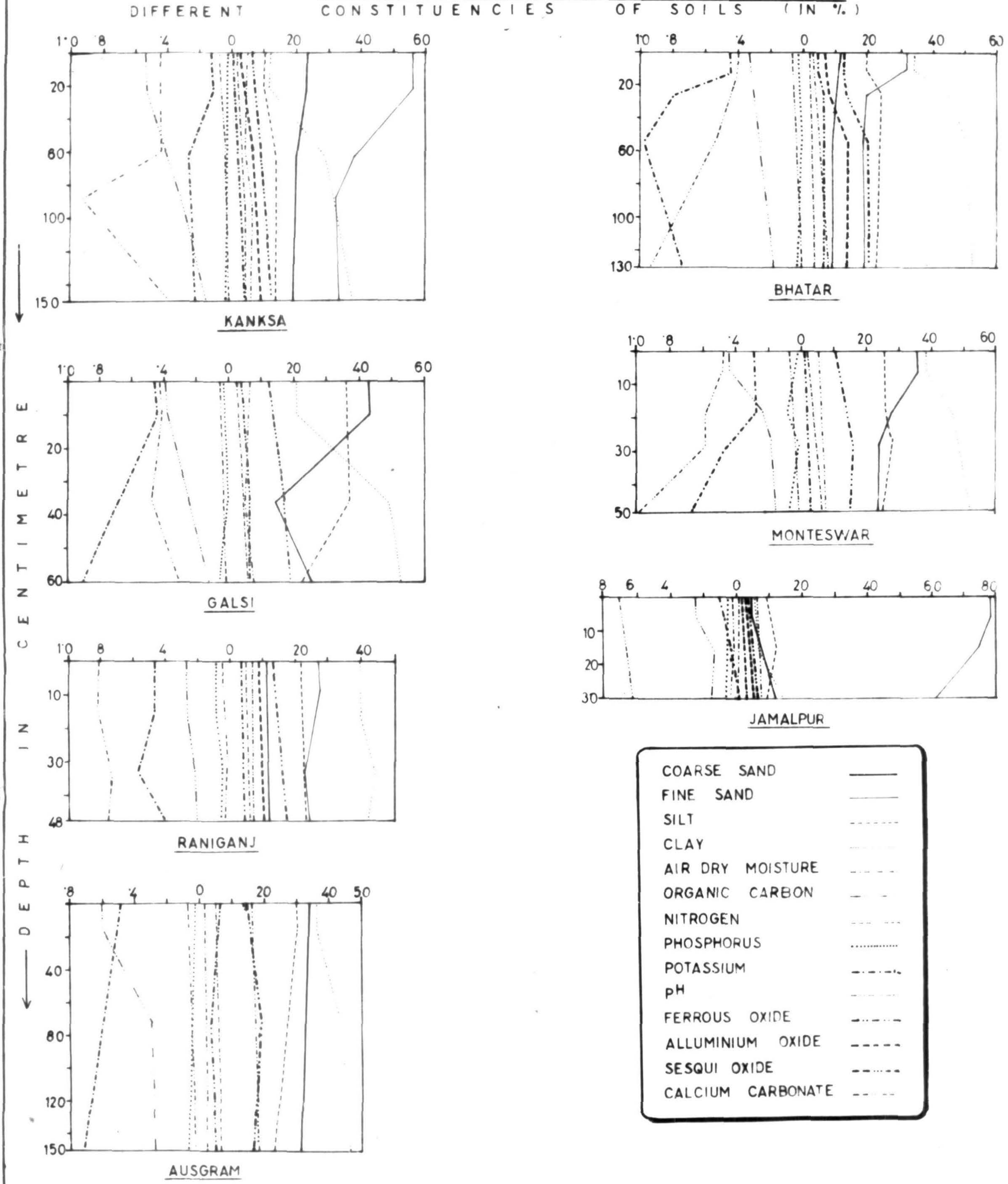
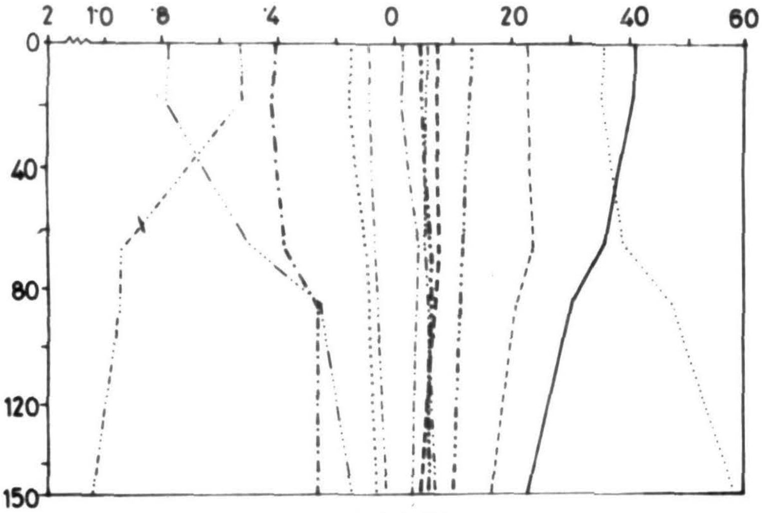
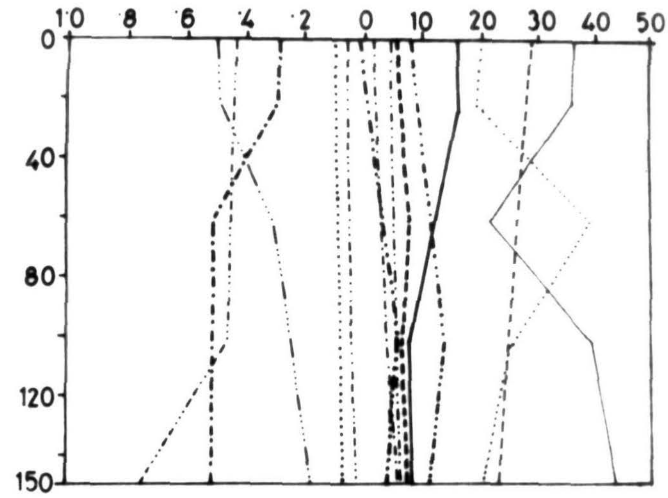


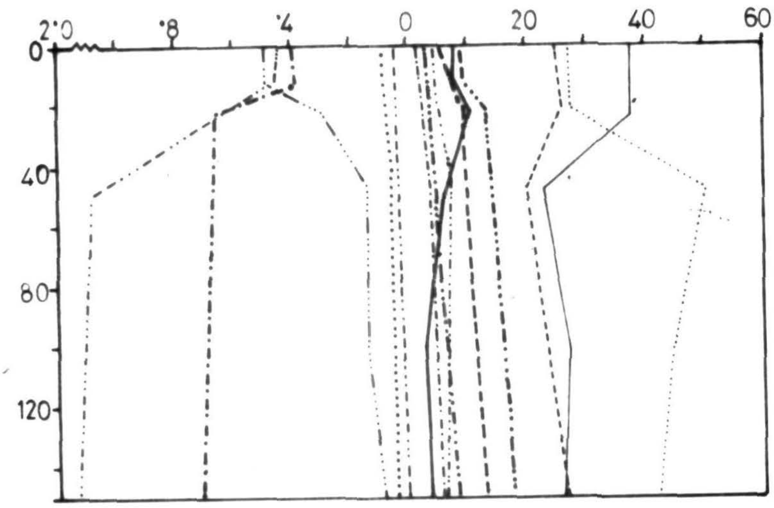

Fig. No. 4



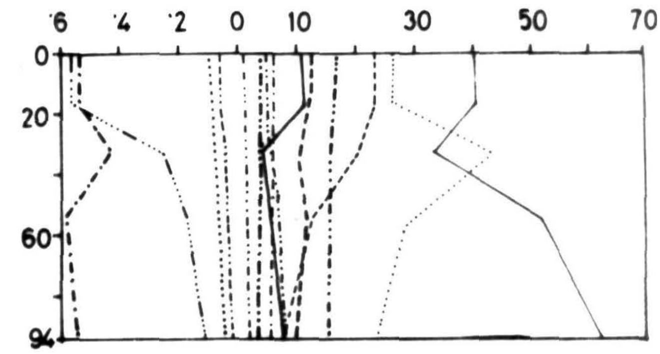

KULTI



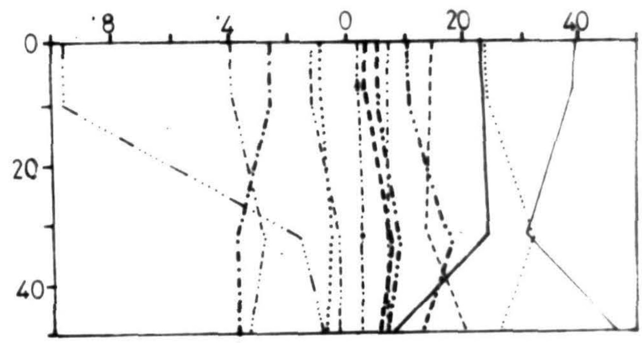

BURDWAN



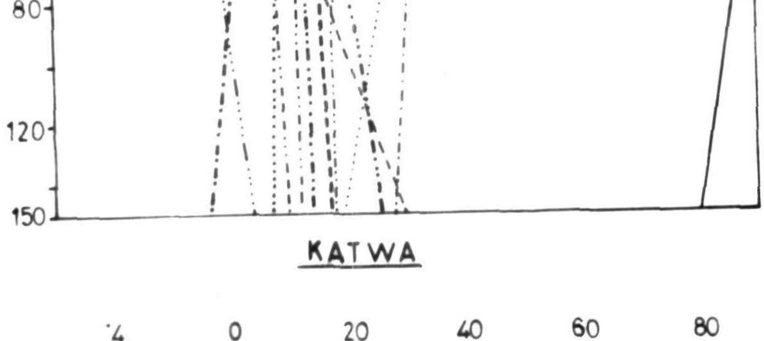

KETUGRAM



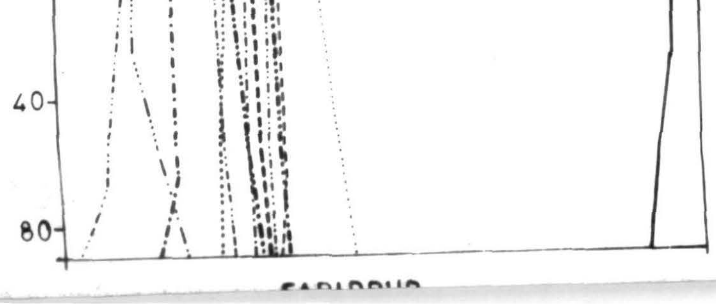

MONGALKOT



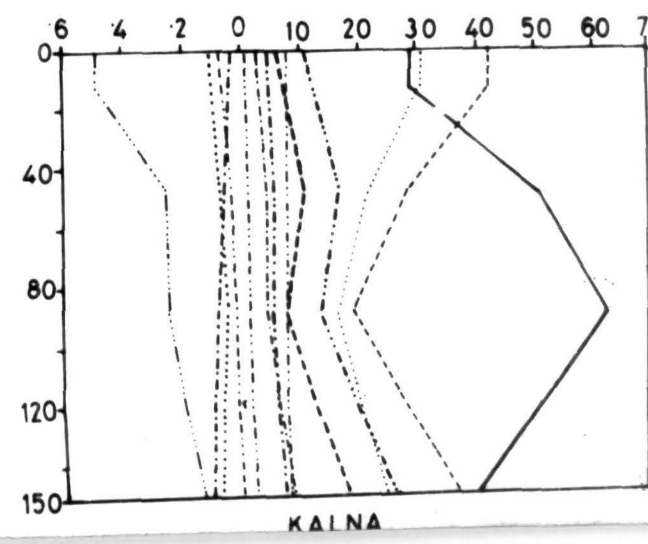

JAMURIA



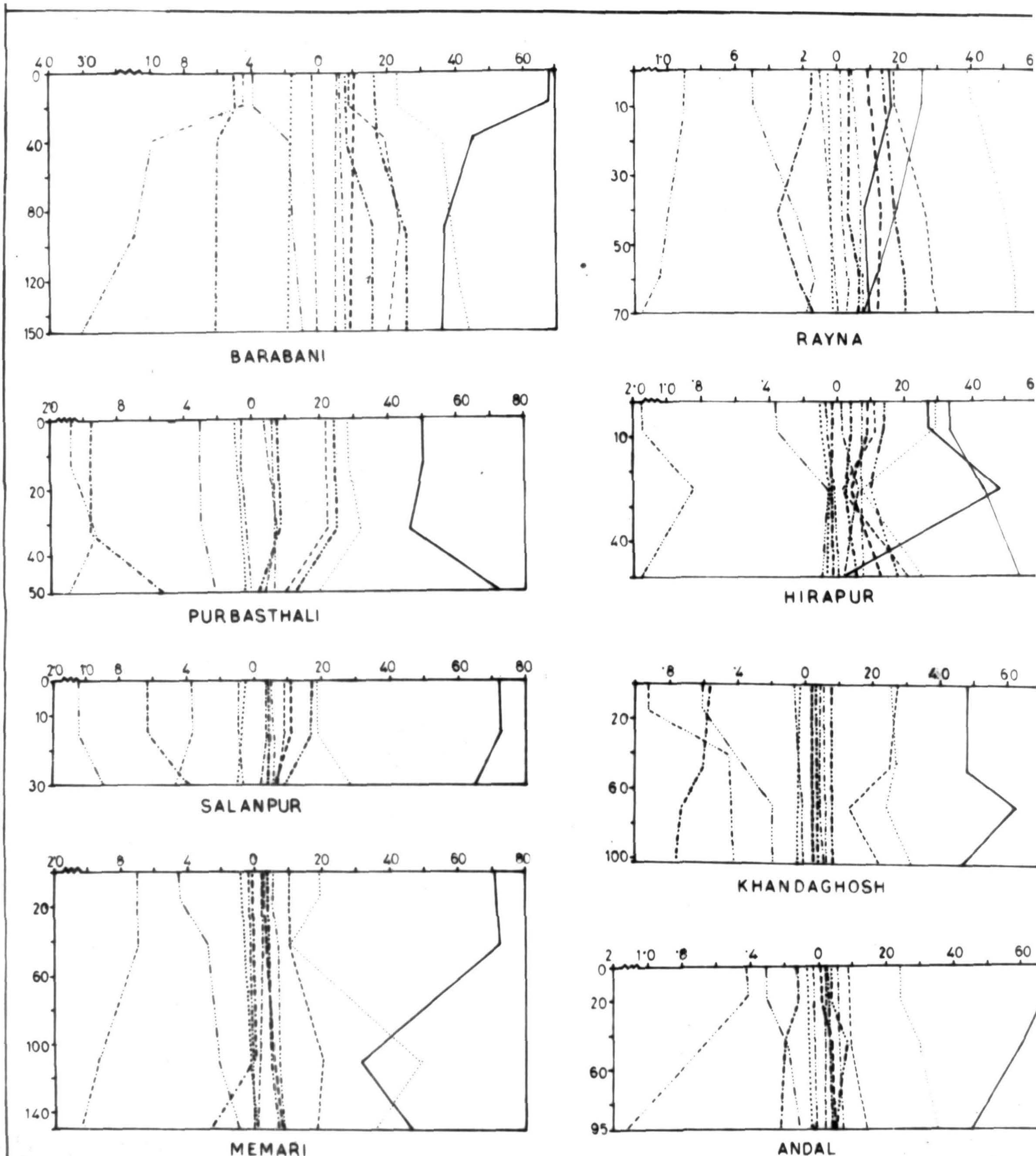

KATWA




FARIDPUR




KALNA


BARABANI
RAYNA
PURBASTHALI
HIRAPUR
SALANPUR
KHANDAGHOSH
MEMARI
ANDAL

immature, in case of soils either formed from recent alluvial deposits or formed due to removal of the superficial material by erosion.

Considering the soil profiles of all police stations (Fig. No. 40 ), one can say that there are great variations of coarse sand, fine sand and clay content throughout the profile of all police stations. Silt and potassium content show moderate variation. Other chemical composition (pH, air dry moisture, nitrogen, phosphorus, ferrous oxide, al~~l~~uminium oxide and sesquioxide ) exhibit variation throughout the profile. In this case, variation means that chemical content either increases or decreases with depth in an irregular fashion. Generally according to the slope and flow of the river the percentage of sand varies from place to place over the district. Due to slope variation and action of running water, the chemical compositions are either leached out to the B-horizons or transported to the low plain lands of the eastern part. The principal soil compositions of each police station are shown in a graph.

Modern Soil classification and soil sub-group (Great Group Association) of Burdwan district.

In the comprehensive system of soil classification (U.S. D.A. 7th approximation), the 28th soil series of the district

of Burdwan have been grouped into 9 soil sub groups and named after the prominent series of that group. (Fig No 41)

1. Ultic Paleustalfs -- Plinthustalfs Association -

This includes soil of Beldanga sub group (Beldanga, Bastupur soil series) and Sankarpur sub group (Sankarpur, Kamalpur and Vijoynagar soil series) with limited extent of soils Kalyanneswar sub group.

The soils are moderately deep, well drained reddish yellow or red coloured with mixed mineralogy underlain by massive hard laterite and nodular ferruginous beads with quartz gravel. They occur on upper and middle piedmont slopes. These soils are unsuitable for crop production. Organic manures with fertilisers and adequate irrigation should be applied for cultivating the soil.

2. Udic Haplustalfs - Aeric Ochraqualfs Association.

This includes soils of Chalbalpur sub group (Chalbalpur, Chanda and Salanpur soil series) and Majiara sub group.

These soils are very deep, moderately well drained, brownish in colour, with mixed mineralogy. They occur on gentle piedmont slopes in the undulating region. This type of soil is used for cultivation of paddy and pulses. It is necessary to apply manures and fertilizers in these soils.

3. Ultic Paleustalfs - Aeric Ochraqualfs Association.

This includes soils of Beldanga subgroup and Majiara subgroup with limited extent of soils of Chalbalpur and Sankarpur subgroup. These types of soil are like that of the aforesaid subgroup.

4. Typic Ochraqualfs - Plinthustalfs Association.

This includes soils of Hanrgram subgroup (Hanrgram, Amrargarh, Anantapur, Kuldiha, Totpara, Madhupur, Sardanga and Srirampur soil series) and soils of Sankarpur subgroup with limited extent of soils of Beldanga subgroup.

The soils are very deep, poorly drained brownish grey coloured with mixed mineralogy. They occur on gently sloping land. The drainage condition and soil colour indicate combination of sub aqueous and subaerial weathering. Therefore, improvement of drainage system and land management practices should be done for crop production.

5. Typic Ochraqualfs - Typic Ustifluvents Association.

This includes soils of Hanrgram subgroup and Goghat subgroup (Goghat and Moalia soil series) with limited extent of Multi subgroup.soils.

These soils are very deep, moderately well drained, yellowish brown coloured with mixed mineralogy. They occur on flood plain area and are distinctly mottled with stratification. Addition of organic manures and inorganic fertilizers can enhance crop production.

6. Typic Ochraqualfs - Typic Haplaquepts Association.

This includes soils of Hanrgram subgroup and Multi subgroup (Multi, Banpara, Sasanga and Balidanga soil series).

The soils are very deep, poorly drained, greyish brown in colour with mixed mineralogy. The soils are under paddy cultivation. By improving the drainage system and land management the fertility of the soils can be maintained.

7. Typic Haplaquepts - Typic Haplaquents Association.

This includes soils of Multi subgroup and soils of Krishnadevpur subgroup with very limited extent of soils of Hanrgram and Goshat subgroup.

These soils are very deep, moderately well drained, greyish brown coloured with mixed mineralogy. They occur on flood plain area of river Ganga and are slightly alkaline. With application of manures and fertilizers, cultivation can be practised in these soils.

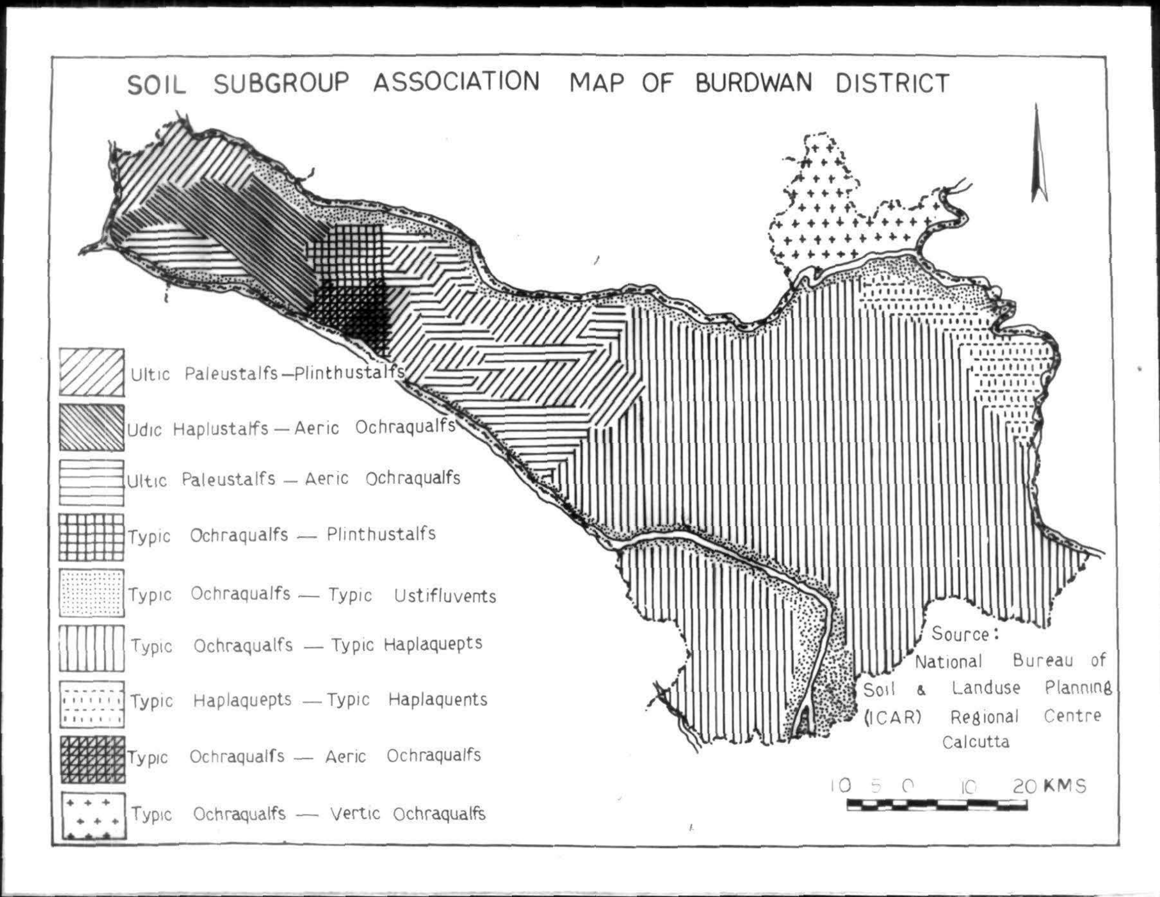

SOIL SUBGROUP ASSOCIATION MAP OF BURDWAN DISTRICT
Ultic Paleustalfs—Plinthustalfs
Udic Haplustalfs — Aeric Ochraqualfs
Ultic Paleustalfs — Aeric Ochraqualfs
Typic Ochraqualfs — Plinthustalfs
Typic Ochraqualfs — Typic Ustifluvents
Typic Ochraqualfs — Typic Haplaquepts
Typic Haplaquepts — Typic Haplaquents
Typic Ochraqualfs — Aeric Ochraqualfs
Typic Ochraqualfs — Vertic Ochraqualfs
Source:
National Bureau of Soil & Landuse Planning (ICAR) Regional Centre Calcutta
10 5 0 10 20 KMS

Fig. No. 41

8. Typic Ochraqualfs - Aeric Ochraqualfs Association.

This includes soils of Hanrgram subgroup and Majiara subgroup with limited extent of soils of Goshat subgroup. These soils are almost similar to the types of soils of Beldanga subgroup.

9. Typic Ochraqualfs - Vertic Ochraqualfs Association.

This includes soil of Hanrgram subgroup and Nabagram subgroup with limited extent of soils of Kutubpur subgroup.[8]

These soils are very deep, poorly drained greyish brown in colour with mixed mineralogy. They occur on gently sloping land at the upper flood plain of river Bhagirathi. Soil condition is fairly good. The moisture retentive capacity is high. For increasing the productivity of soil, organic manure should be added. Application of organic matter in the improvement of soil productivity is almost indisputed, but the actual role played by them is not clearly understood.

Among the above group of soils Typic Ochraqualfs - Typic Ustifluvents are very fertile, though the lands are much susceptible to flood during rain. The soils of subgroup Typic Ochraqualfs - Typic Haplaquepts are very rich from agricultural point of view. The soils under the subgroup Ultic Paleustalfs - Plinthustalfs, Udic-Aeric Ochraqualfs, Ultic Paleustalfs - Aeric Ochraqualfs and Typic Ochraqualfs -

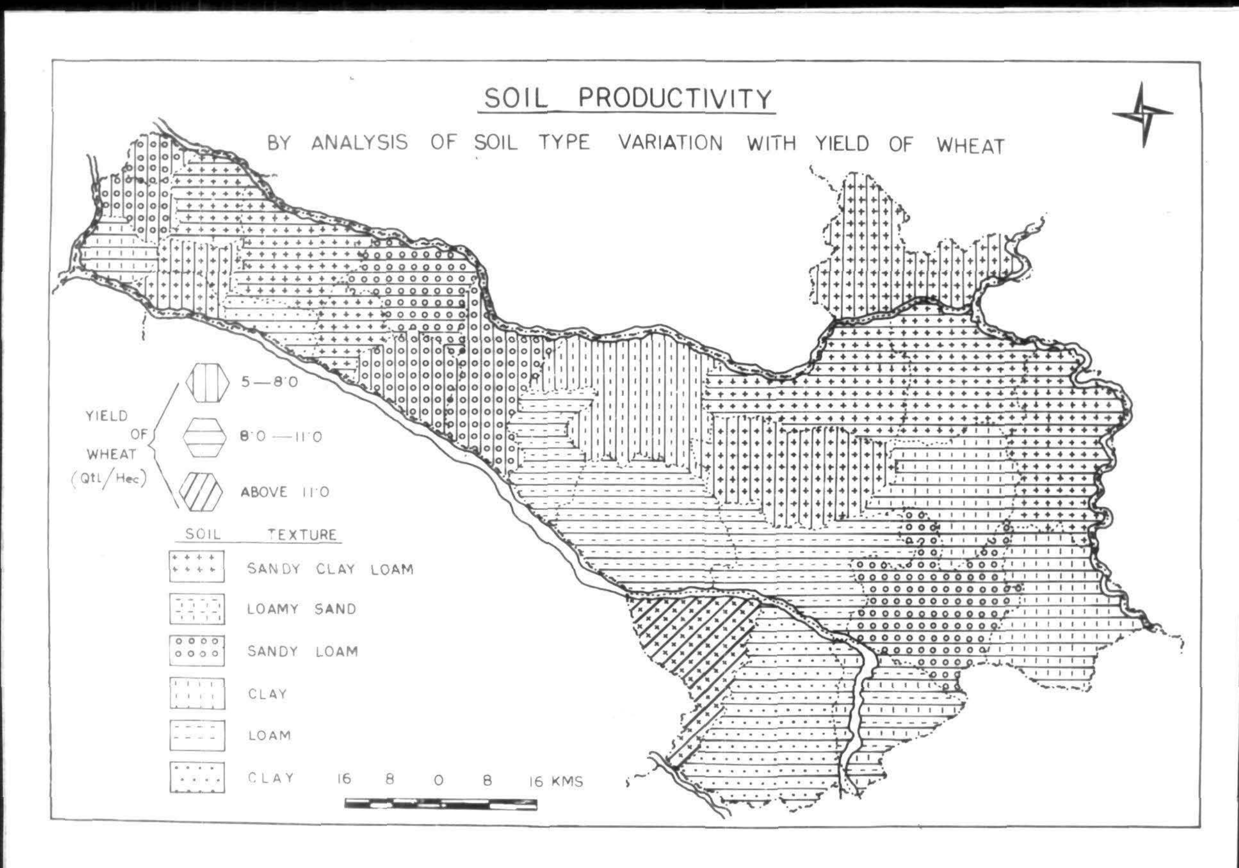

SOIL PRODUCTIVITY
BY ANALYSIS OF SOIL TYPE VARIATION WITH YIELD OF WHEAT
YIELD OF WHEAT (Qtl/Hec)
5—8·0
8·0—11·0
ABOVE 11·0
SOIL TEXTURE
SANDY CLAY LOAM
LOAMY SAND
SANDY LOAM
CLAY
LOAM
CLAY
16 8 0 8 16 KMS

Fig. No. 42

Plinthustalfs are less fertile. The moisture content is very low in less fertile soil. The fertility of soil can be regained by sufficient and timely irrigation and suitable crop rotation, which will help raise the productivity of soil.

Soil and crop relation : It is the nature and character of the soil which determine the production of crop. In the eastern zone, paddy, wheat, jute and sugarcane are cultivated and little quantity of vegetables are grown. The vast agricultural land, alluvial soil and timely irrigation of eastern part are the favourable factors for crop production. The undulating land, gravelly soil and scarcity of water are inhibiting factors for crop production over the western part. In this part where the soil is laterite and gravelly, the predominant crops are pulses, vegetables, paddy and wheat. The production of pulses is high in this area.

Deficiency in requisite improvement in technology and unscientific use of land, together result in declining trends in physical productivity and deterioration in the natural resource base of the region. The reduced physical availability of natural resources is indicated by the growth of waste land resulting from removal of top soil through conversion of fertile lands into patches of fallow lands.

<u>Conclusion</u> : Proper soil conservation can reduce the waste of usable moisture and can ensure its efficient utilisation. The possibility of substantial increase in the productivity of lands through soil conservation measures and effective utilization of available water are expected to enhance the yield of crop in the western part. "The agriculturists started advocating the use of farmyard manure, compost and green manures for increasing the matter content of our soils".[9]

Rotation of crop should be followed in such a way that fertility of soil can be maintained. The western part of the district requires more irrigated water for proper cultivation and for production of atleast two crops within a year. HYV seeds require more chemical fertilizer and pesticides. Moreover, the chemical fertilizer (NPK) requires more water for dissolving N, P, K content within the soil. There is much difference in the fertility, composition and productivity of soil from western to eastern part of the district. This spatial difference of soil fertility is showing a trend of increasing manifold due to human negligence at the western part and proper and effective tilling at the eastern part. The soils of Burdwan have high productivity. This inherent quality of soil gradually diminishes due to lack of suitable crop rotation and crop cultivation. The soil structure may be affected by too much application of tractor and as a result

hampers the growth of crop. The soil tilled by tractor is not as much fertile as the soil tilled by plough. There are vast fallow lands at the western part which can be reclaimed by plantation of cash crop or afforestation. The fertility of the soil can be maintained by applying equal proportion of chemical fertilisers and green manure. Nitrogenous fertilisers may be applied to the soils with poor nitrogen content and similarly the phosphate fertiliser and potash may be applied with sufficient supply of water. It is necessary to give equal attention to the cultivation of land both in the western and eastern part of the district. The whole of Burdwan district will produce much more through the equal distribution of input and care. In the late twentieth century, the introduction of modern technology and optimum application of fertilizers are expected to improve significantly the productivity of the soil.

## Ground water and its influence on agriculture

Introduction : The supply of water and the relative height of the sub-soil water are of considerable importanee in agriculture. The district of Burdwan is one of the important rice baskets in India. It contributes a large amount of paddy which is a wet crop and grown in mud and water. It is difficult to rely upon rain water, as it comes abruptly for uncertain period during the monsoon months. But for the growth of wet crop, timely and sufficient supply of water are essential requirements. "The vagaries of the monsoon are well known and there is no method for the controlling of the rainfall, and accordingly the conservation of rain-water in the soil by obstructing and retarding its flow over the land is a task of paramount importance".[10] Even the rain water is not found adequate as it is not available in right quantities and at the right time. Therefore, the supply of water by irrigation is very important in this district, as the principal wet crop paddy requires plentiful supply of water and high water table.

Availability of ground water : Agricultural production is mainly dependent upon rainfall, though the district has a good supply of water from the rivers, yet the district suffers from irrigation problems. There are three inter related factors - geological setting, physiographical

features and climate. These factors are responsible for the development of ground water. "Truly, they represent the three vartices of a triangle in any programme of prospecting for shallow ground water".[11]

<u>Slope</u> : At the western part of the district, water scarcity is the main problem due to undulating, sloping land with less number of streams and rivers. Spatio-temporally ground water varies due to the presence of slope. The aquifer zone slopes gradually to the east and south east while the gradient is steeper in the west. Due to slope of land towards east, the depth of aquifer gradually increases towards west. The net work of drainage system in the eastern part is more favourable for the supply of water as compared to the western part.

Ground water is one of the sources of irrigation for agricultural development, though there is little scope to expand the facilities of ground water. The level of ground water fluctuates from west to east. "In the eastern part the floodplain zone of the Bhagirathi and in the western part in a narrow sector of the Damodar basin unconfined occurrence of the ground water is the chief hydrological feature of the ground water regime2[12].

<u>Lithological character</u> : In the Gondwana terrain at the western part of the district, the subsurface water occurs under water table conditions in the weathered mantle and

circulates through joints, fractures, fissures of the near surface sandstones and shales. In the alluvial terrain at the eastern part of the district, the ground water occurs both under water table conditions in the shallow aquifers and under semiconfined conditions in the deeper aquifers. "In the western part of the district, the thickness of the quaternary sediments is 40m - 50m and increases to more than 150m. in the eastern part of the district."[13] At the western part of the ground water occurs in the fractured and weathered portions of the older rocks and in minor channel filled sediments of some streams. In the district, with the exception of the western most older rocks of Tertiary - Gondwana terrain, the aquifers range in thickness from 50 m to 125m.

In this area the ground water reservoirs are controlled by different factors of geomorphology - such as types of rocks, permeability of rocks and the drainage pattern. In the Archean tract, at the western part, a number of faults have been recognised which comprises several hillocks and ridges of paraschists, gneisses and quartzite. Just eastern part of these rocks, i.e. Raniganj-Asansol area is formed by older Gondwana terrain, which comprise a thick series of shales and sand stones with intercalations of coal seams. Next to this further to the east, the Durgapur beds consisting of

laterite, sandstone, felspathic grits and mottled clays belong to the upper Tertiary age, which is limited to central part of the district. These are formed by sub-aerial weathering of the rocks in a monsoon climate with alternate dry and wet seasons. Laterites are usually succeeded by the next younger group of sediments of the quaternary era. Lithologically, the sediments consist of massive beds of clay, either sandy or calcareous. These alluvial deposits are classified into older alluvium of middle pleistocene age and newer alluvium composed of assorted boulders, pebbles and gravels with abundant calcareous and limonite concretions. Newer alluvium is essentially confined to the banks and beds of present day river channels, which are loosely compacted with filled and organic matter rich sediments. The thickness of the alluvium is directly proportional to the qualitative ground water prospects.

Rainfall : Mostly the crops suffer from untimely and fluctuating rainfall. The eastern part suffers less from irrigation problem, as the land is plain and there exist more rivers and streams. Spatio-temporally ground water varies due to the presence of fluctuating rainfall. The surface water percolates underground through joints, cracks, and pores of the rocks. The storage of subsoil water is one

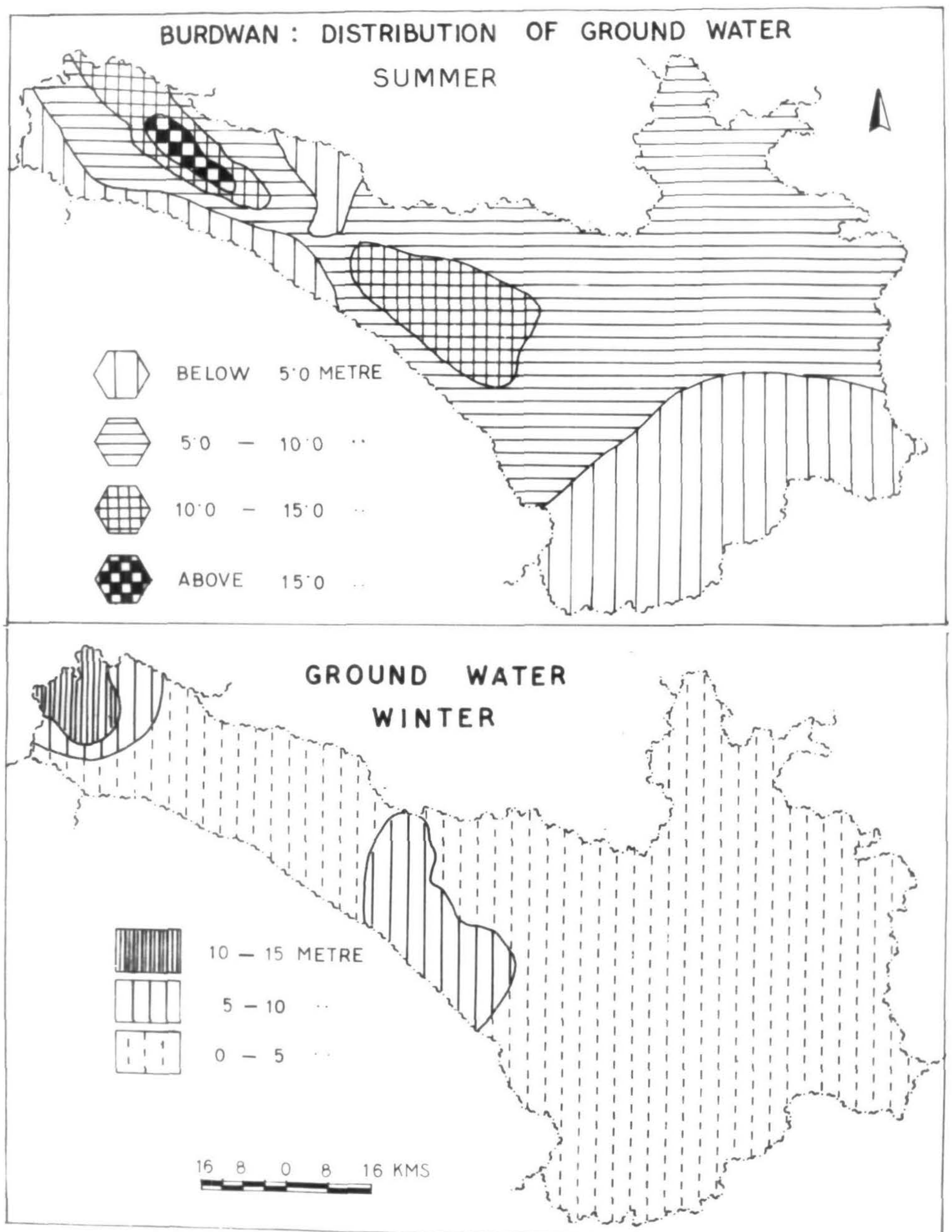

BURDWAN : DISTRIBUTION OF GROUND WATER
SUMMER
BELOW 5·0 METRE
5·0 — 10·0 ..
10·0 — 15·0 ..
ABOVE 15·0 ..
GROUND WATER
WINTER
10 — 15 METRE
5 — 10 ..
0 — 5 ..
16 8 0 8 16 KMS

Fig. No. 43

of the most important function of an irrigation system because the rainfall is not sufficient as to raise the subsoil water to such a level that wet crops can be cultivated timely. Thus a good amount of water is needed to be stored up in the soil. Agricultural production is much dependent upon subsurface water due to irregularities of rainfall and inadequate surface water.

Variability of ground water in different zones :

Spatial analysis of ground water conditions of the district show that the depth of water table ranges from 1.3 metres to 40 metres in pre-monsoon period and from 1.0 m. to 7.0 metres in post-monsoon period.

"The recession of water table in summer (pre-monsoon period) in the vicinity of the active mines has been recorded to be high, due to drainage of ground water through joints and fractures at the minefaces".[14]

The agriculture of central and eastern part of the district is facilitated by canal water. The map (Fig.No. 43) shows the summer ground water condition of the district, which illustrates the depth of ground water increases with the altitude. At the south eastern part, the depth varies from 1.0 to 5.0 m. which gradually increases towards west. North

western part shows the high depth of ground water, which ranges from 15.0 - 20.0 metres. There are low (below 5.0 m) depth of ground water at the left side of river Damodar and a little part at the right side of river Ajay in the western part. Supply of water in the river depends partly upon sub-surface water and partly upon rainfall. That is why, the sub-surface water is available at the low depths in the adjacent area of Damoder and Ajay catchment. Figure (Fig. No. 43) shows the winter (post monsoon) ground water condition, which illustrates the depth, varies from 1.0 to 5.0 m in the vast plain land of eastern part and a little area at the western part of the district. At the central part, the depth varies from 5.0 to 10.0 m and at the north western part the depth is high it ranges from 5.0 to 12 m. After the monsoon the depth of ground water decreases all over the district, as the water penetrates through cracks, joints and fractures of different types of rocks.

Dr. A.C. Bentley[15] in his report on 'Malaria and Agriculture in Bengal' submitted in 1925 incidentally narrates the decline of agriculture in the district of Burdwan in a graphic manner and makes the following observations - viz. (i) that the river dried up owing to silting up; (ii) that the soil was impoverished by the stoppage of

irrigation by means of river water; (iii) that the subsoil water level fell; (iv) that the net cropped area was going out of cultivation because of lack of water and (v) that the ravages of malaria took a heavy toll of agricultural labour.

Conclusion : For increasing the amount of subsurface water for irrigation the necessities are : (1) prevention of rapid escape of surface water into rivers and water courses;
(2) storage of surface water in tanks for irrigation
(3) avoidance of water logging and (4) optimum ulilisation of subsurface water.

During the last two decades, the double cropping and multiple cropping practices were started. Each plot of land requires much more intensive irrigation than usual for multiple cropping practices. Though the eastern part is benefitted by canal water, yet more and more water is needed for cultivating land distantly situated from canal. The western part of the district grows only one crop with the help of monsoonal rain. To ensure double and triple crops, tube wells, tanks and wells should be constructed in these areas concerned. Within the surface water command area, where irrigation water cannot be provided, during the Rabi season, tube wells may be constructed to supplement surface water for plots where canal water cannot reach. At the western part of the district, tube wells, wells

and tanks with greater depth should be constructed than in the eastern part and in the adjoining areas of rivers. From the tanks and wells the water can be passed through a net work of channels into the cultivated land. There is a great scarcity of electricity and diesel. Besides, majority of agricultural labourers, being very poor, cannot afford sufficient money for irrigation purposes. It is possible to avoid consumption of power and electricity for expanding the scope of irrigation since the poor farmers are born in debt, live in debt and die in debt. Hence, it can be concluded that there is plenty of scope for expansion in methods and practices of utilisation of ground water in this area. The district can and does produce more through multiple cropping practices by expanding equally the scope of irrigation.

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14. Bulletins of Central Ground Water Board, 1978. Calcutta.

15. Bentley, Chas. A. 1925. pp. 18-82. 'Malaria and Agriculture in Bengal'. Secretariate Book Depot, Calcutta.

<u>Data collected from</u> :

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2. The Composition of Soil, Technical Bulletin No. 6, Government of West Bengal.
3. Central Ground Water Board, Calcutta.

# CHAPTER - V

## CHANGES IN LAND UTILISATION AND TRENDS IN AGRICULTURAL PRODUCTION IN THE DISTRICT OF BURDWAN

Introduction : Burdwan occupies a top rank in West Bengal from agricultural point of view. The major part of the land in the district is utilised directly or indirectly for crop production. The cropped area does not remain constant every year. It fluctuates with the prevailing weather conditions, agro-economic and socio-economic situation. "The economic productivity of agricultural land depends upon two factors : geophysical and economico-social. The dynamic factors in the use of land for production are the economico-social".[1] The economico-social factors are agricultural settlements, general transport facilities, the system of utilisation of land for production, the stage of technical development and the agencies of agricultural marketing. The study of land utilization is a part of the broader field of land economics which in its turn is a part of the still larger area of agricultural economics.

Spatio-temporal analysis of land use : The total cropped area in the district increases with the increase in the area sown more than once and decreases in the fallow area. But as area sown more than once cannot increase suddenly in a year, the increase in cropped area comes mainly from the utilisation of fallow lands.

The reason behind the increase of fallow lands are undulated land, lack of irrigation facilities and lack of proper management. After Independence more people have become dependent upon agriculture than in pre-independence era. "The present agricultural policies are more or less directed towards alleviating rather than eradicating the ill-effects of the inherent defects in our system of agriculture,mainly responsible for pitifully low crop yields".[2] Agricultural planning has in fact failed to solve some of the major problems, though many years have passed since introduction of planning. The proportion of net area sown under irrigation was relatively high in Burdwan in the pre-plan year. During the first two plan periods (1951-56 and 1956-61) though irrigational facilities increased more or less, the relative positions of agricultural land use and production did not undergo any substantial change for the better. Agricultural production is the most extensive form of production in its use of land. The extent and quality of land available are vital production factors. Lack of permanent right in land brings its own problems of crop choice and of location.

It is necessary to analyse a systematic land use pattern of agriculture in the district of Burdwan. In the eastern part most of the lands are occupied by agricultural

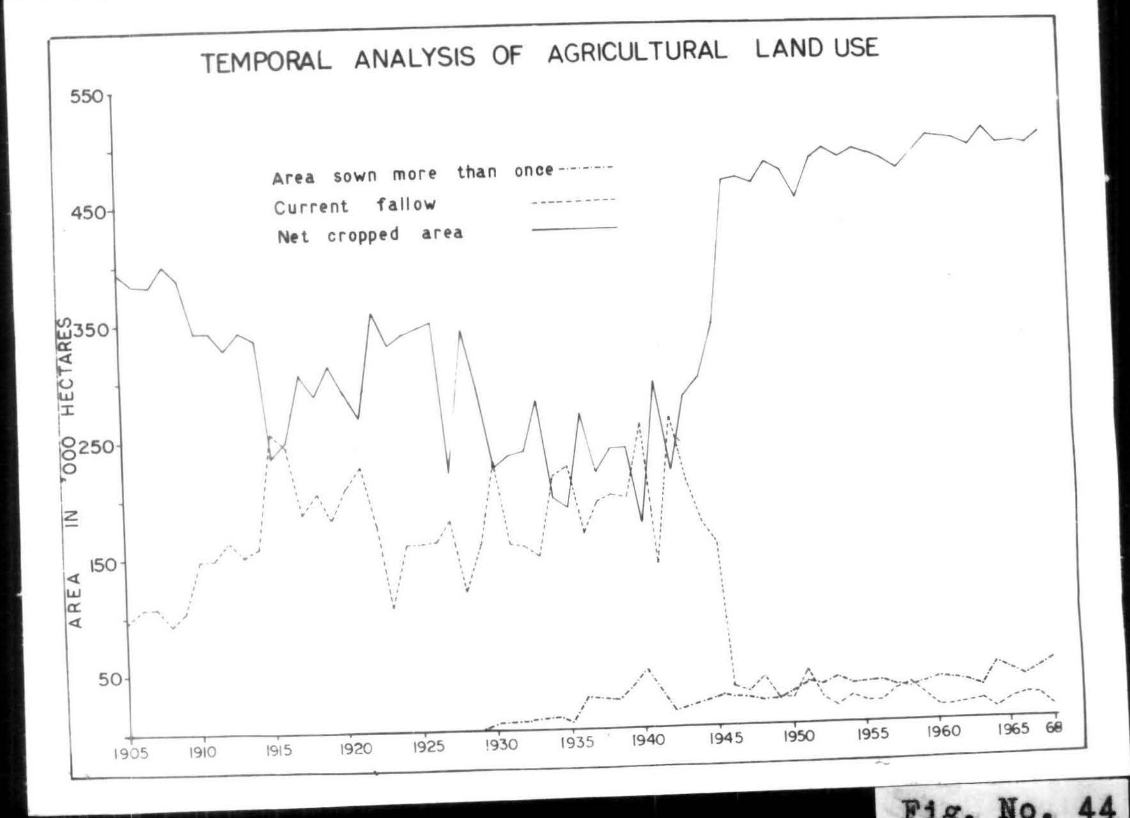



Fig. No. 44

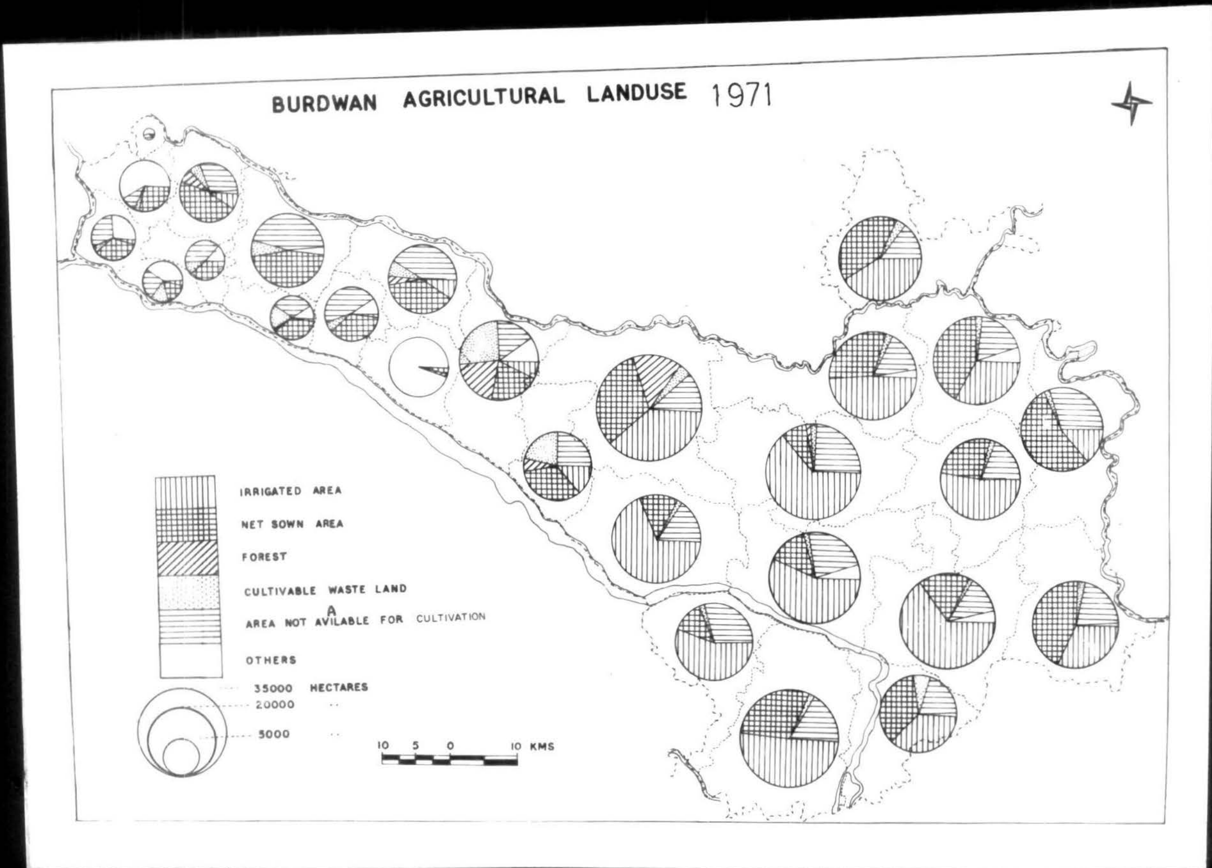



Fig. No. 45

fields, whereas in the Western part large portion of lands are occupied by factory and mining areas. The Figure (Fig. No. 44) illustrates that net cropped area and current fallow lands fluctuated from 1905-06 to 1967-68. Both the curves are increasing or decreasing proportionately i.e. one is decreasing while the other one is increasing. After 1945-46 the cropped area increased and the current fallow land decreased rapidly. This increasing tendency is due to the change in land tenure system and growth of population.

Figure (Fig. No. 45) represents the agricultural land use of 1971 Police stationwise in pie-graph. In the western part, Jamuria P.S. occupies maximum area for cultivation, then comes Barabani, Faridpur and Andal. In the Police Stations of the Western part of the district the proportion of net sown area is less than 50 per cent of the total area. The irrigated areas are insignificant in that part. In those areas the lands are largely used for industrial purposes. The rest of the land remains as fallow land or land not available for cultivation inspite of the vast lands in the eastern part. In the eastern part of the district the lands are mostly used for cultivation. In the Police Stations of the eastern part the proportion of net sown area is 70 per cent or more of the total area. All the Police stations over there are more or less provided with facilities of irrigation. Among them Memari, Galsi and Bhatar occupy more

irrigated areas than Raina, Burdwan, Monteswar, Khandaghosh and Mongalkote. There are less irrigated areas over the rest of the police stations in the eastern part.

About 70 per cent of the total area of the district is net cropped area, while the existing fallow area is 5 per cent.

The proportion of cultivated land in the eastern part of the district ranges between 50 and 70 per cent of the total area; and that in the western part between 20 and 40 per cent.

Area under agricultural crops does not remain constant for all the year. In years with favourable weather conditions and with increasing irrigation facilities, the cropped area increases, and in years with unfavourable weather conditions the cropped area decreases.

not
Land/available for cultivation are large in extent all over the district.

Net sown area ranges from 8 per cent in Chittaranjan to 85 per cent in Memari. As population increases, residential areas expand, more roads are constructed, consequently area under cultivation remains less. In the eastern part there are considerable lands with rivers, canals, tanks

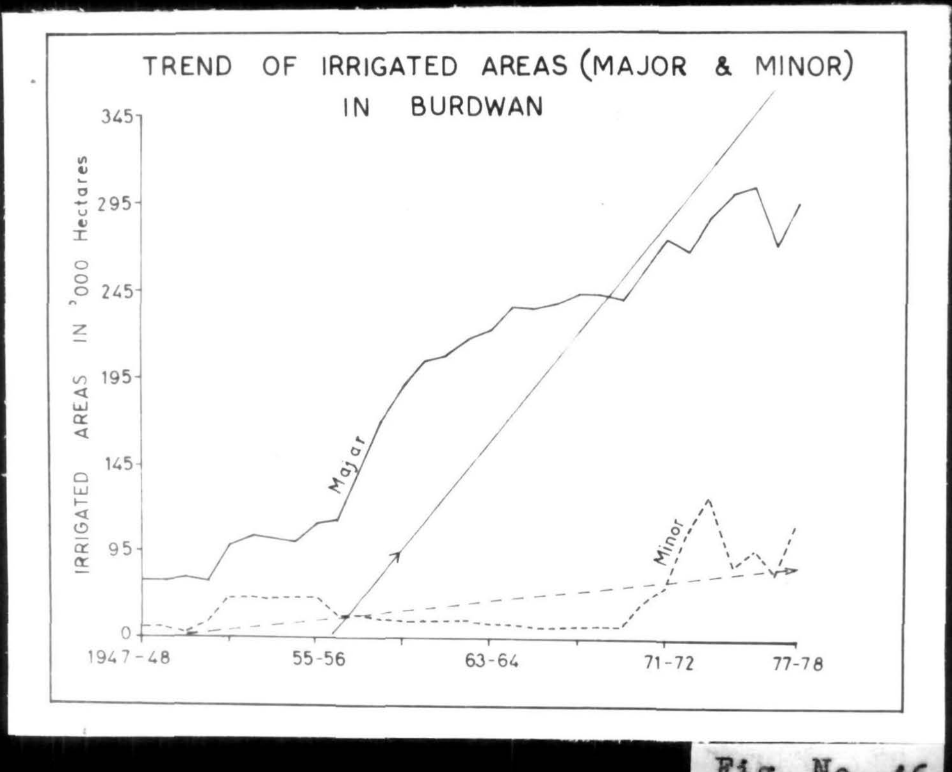

TREND OF IRRIGATED AREAS (MAJOR & MINOR)
IN BURDWAN
IRRIGATED AREAS IN '000 Hectares
345
295
245
195
145
95
0
1947-48
55-56
63-64
71-72
77-78
Major
Minor

Fig. No. 46

and beels. In the western part there are more uncultivated lands under urban agglomerations and transportation network. The continuously growing population pressure leads to an extension of cultivation by reclamation through proper management of the land under fallow and culturable wastes. It may be noted that some of the cultivated land is going out of use as a consequence of various developmental activities. Burdwan registered a rise in the proportion of net cropped area to total geographical area during the first two plan periods, which varies from 3 - 18 per cent. The double cropping practice has been adopted on a relatively small scale, double cropping was adopted on an increasing scale during the First Plan period. During the first two plan periods irrigational facilities increased more or less in the district.

<u>Utilization of land for irrigation</u> : The lands under irrigation served by canal, tank, river, well and tubewell are more in the eastern part than in the western part of the district. Areas under irrigation have increased several times during the 30 year period from 1947-48 to 1977-78 (Fig. 46 ). In 1947-48 total irrigated area was 126479 hectares. After planning in 1950-51 there was extension of the area under canal (Government and Private). Other

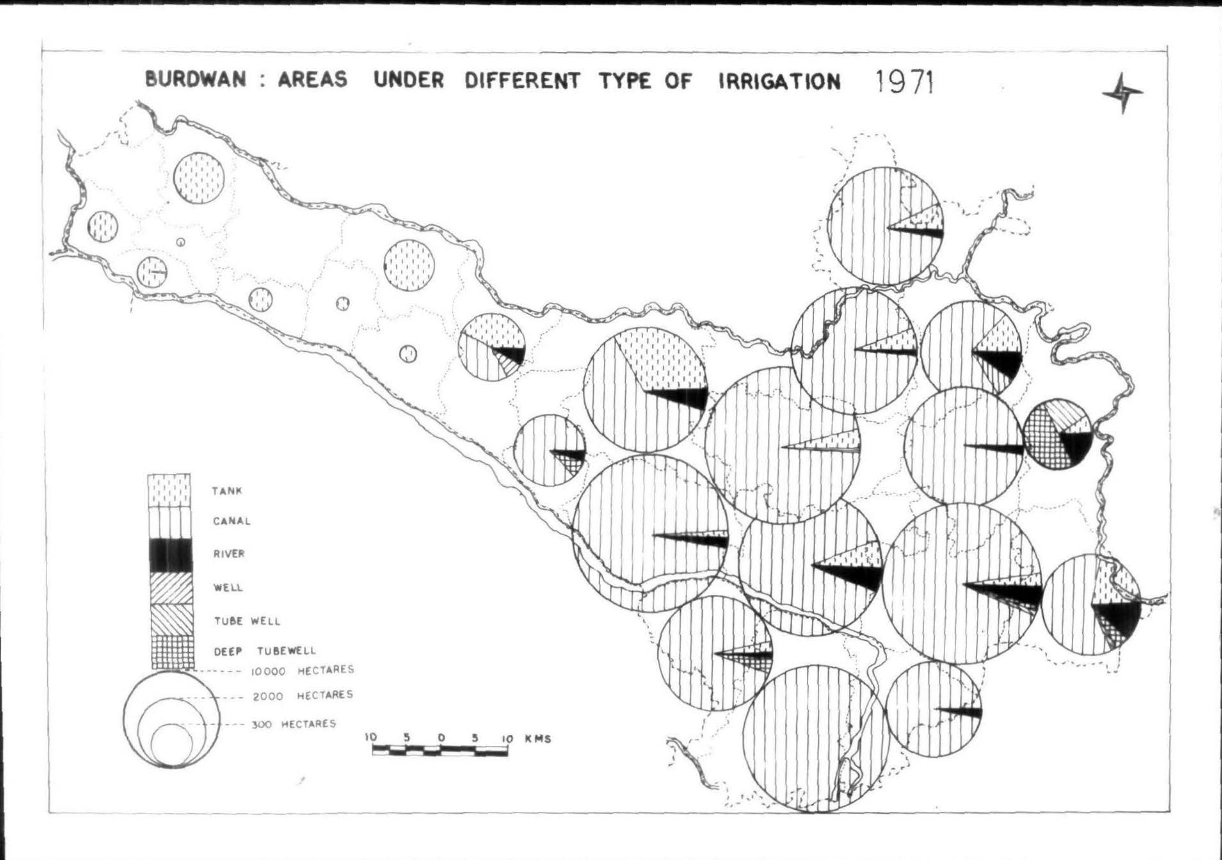

BURDWAN : AREAS UNDER DIFFERENT TYPE OF IRRIGATION 1971
TANK
CANAL
RIVER
WELL
TUBE WELL
DEEP TUBEWELL
10000 HECTARES
2000 HECTARES
300 HECTARES
10 5 0 5 10 KMS

Fig. No. 47

sources of irrigation i.e. well, tubewell etc. lands are gradually increasing from early period till now. But the lands required for digging tanks are not increasing because many tanks are transformed into low cultivated lands or fallow lands due to deposit of waste material or non-utilisation of those tanks. After 1968-69 the data on areas under different methods of irrigation are not available except on the areas served by Government canals.

The irrigated areas under Kharif crops are more than those under Rabi crops. In 1963-64 it was 238517 hectares for Kharif and 22037 hectares for Rabi crops. Irrigated area for Rabi crops is increasing very rapidly after introduction of high yielding variety. In 1970-71 it increased to 297015 hectares for Kharif and 92384 for Rabi and in 1977-78 the irrigated area reached 338118 hectares and 158055 hectares for Kharif and Rabi crops respectively. Of the various irrigational sources canal provides irrigation to rapidly increasing areas.

An analysis of the area under irrigation spatially shows (Fig. 47 ) that the western part of the district is completely devoid of irrigational facilities. There are only a few tanks for small irrigated area over Durgapur, Asansol, Hirapur, Kulti, Salanpur and Chittaranjan. The area

under irrigation is more in the eastern part of the district, where canal, rivers, tanks, and other irrigational sources are spread over a large area. Memari, Bhatar, Galsi, Raina, Burdwan have more area under irrigation. The proportion of net area sown under irrigation was relatively high in Burdwan in the pre-plan period. During the first two plan periods irrigational facilities increased more or less in the eastern part of the district. Despite the increased in facilities, the relative positions of agricultural production in the district has not undergone any substantial changes.

The sources of irrigation are fully dependent upon climate. When the monsoon fails, the D.V.C. system, which itself depends on rainfall to supply irrigation water cannot meet the normal requirements of the crops. The level of standing water in fields, both in canal irrigated and rain-fed areas, depends heavily on the strength of the monsoon. The major achievements of the IADP in the district are to increase the irrigation potential during the cropping season and to expand the opportunities for double cropping. As a result, between 1962 and 1970 the total area under double cropping increased from 7 per cent to about 20 per cent. The State Government decided to extend loans to small farmers for shallow tubewells to help raise the gross cropped acreage.

The cultivators are generally poor and they do not want to use water from Government canals unless weather conditions are extremely adverse. With the development in irrigation facilities clear ideas about utility and scope of irrigation evolves gradually. In the past the district depended much on well and tank irrigation. Within 10 years of Independence the acreage of private canals increased by about 100 times. Now eastern part of Burdwan gets most of the benefit of irrigation from Government canals. Within thirty years after Independence the production of agriculture virtually increased several times due to land reform, irrigational facilities and new techniques.

Change of land use : The utilisation of land changes slowly during 1947-49 to 1977-78. There are several factors behind such changes. Most of the ahanges are influenced by socio-economic factors. The following table shows the different classifications of area given in hectares :

Table 1

| | | 1950-51 | 1960-61 | 1970-71 |
|---|---|---|---|---|
| Total area | .. | 701217 | 701257 | 699572 |
| Gross cultivated area | .. | 498797 | 534114 | 566289 |
| Net sown area | .. | 478102 | 498474 | 458889 |
| Net irrigated area | .. | 131062 | 259686 | 254280 |
| Area sown more than once | .. | 20695 | 35640 | 107400 |
| Area under forest | .. | DNA | 281884 | 27438 |
| Area not available for cultivation | .. | 127372 | 138307 | 148837 |
| Other uncultivated land excluding current fallows | .. | 72130 | 35842 | 26800 |
| Current fallows | .. | 24300 | 10449 | 43600 |

[ Source : Economic Review ]

It has been found that there has been insignificant changes of landuse during 1950-51 to 1970-71. As it is, lands are not available for cultivation due to increasing urbinisation. Net area irrigated and area sown more than once increases simultaneously during that period. The increasing tendency of area under canal helps to raise the gross cropped area. The areas of uncultivated land excluding current fallow lands decrease during the above-mentioned period. Instead, areas covered by factories and roads have gone on increasing.

It is very strange that after introduction of HYV and technological innovations the current fallow lands has increased four times in 1970-71 from what it was in preceeding decades. Measures should be devised to see that the existing area of fallow lands is diminished and transformed into cultivated land or forest or any cash cropped land as and where necessary.

Table 2

| Name of the P.S. | | Percentage of double cropped area 1954-55* | 1971-72** |
|---|---|---|---|
| Jamalpur | ... | 11.7 | 62.26 |
| Raina | ... | 2.69 | 18.55 |
| Galsi | ... | 4.16 | 63.11 |
| Ausgram | ... | 1.05 | 13.30 |
| Bhatar | ... | 2.39 | 15.60 |
| Burdwan | ... | 1.77 | 48.48 |
| Memari | ... | 7.31 | 71.52 |
| Khandaghosh | ... | 4.41 | 16.67 |
| Jamuria | ... | 0.24 | 3.06 |
| Raniganj | ... | 1.33 | 12.55 |
| Andal | ... | 0.16 | 10.34 |
| Faridpur | ... | 0.24 | 7.15 |
| Kanksa | ... | 1.46 | 15.23 |
| Asansol | ... | 0.06 | 6.19 |
| Kulti | ... | 0.31 | 0.54 |
| Hirapur | ... | 0.26 | 3.84 |
| Barabani | ... | 0 | 2.98 |
| Salanpur | ... | 0 | 0.58 |
| Mongalkote | ... | 5.33 | 19.90 |
| Ketugram | ... | 8.37 | 15.98 |
| Katwa | ... | 7.31 | 35.36 |
| Kalna | ... | 8.28 | 41.67 |
| Monteswar | ... | 1.08 | 22.37 |
| Purbasthali | ... | 13.10 | 38.03 |

Source : * Directorate of Land Records & Land Revenue of West Bengal.

** Statistical Abstract of West Bengal, 1975.

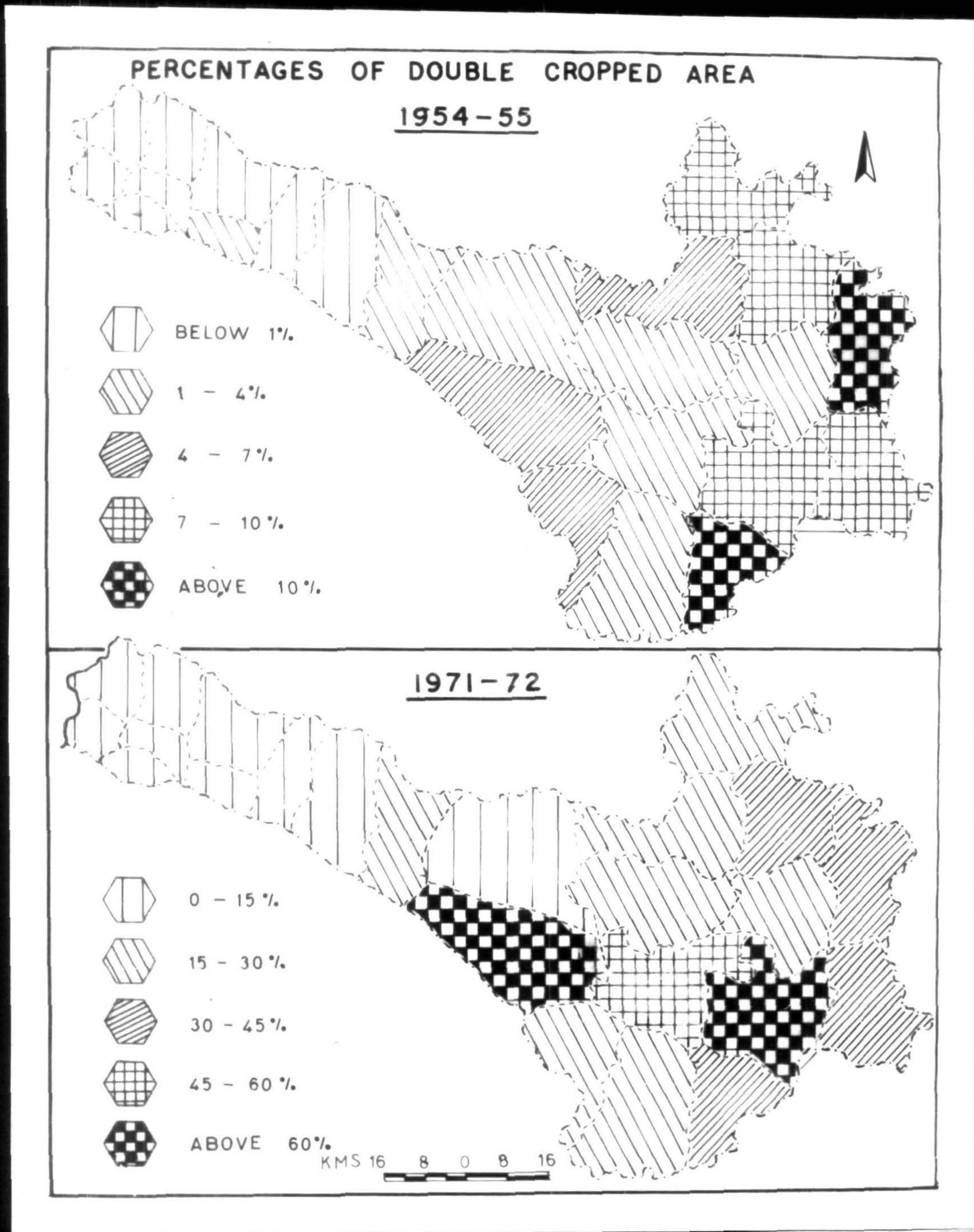
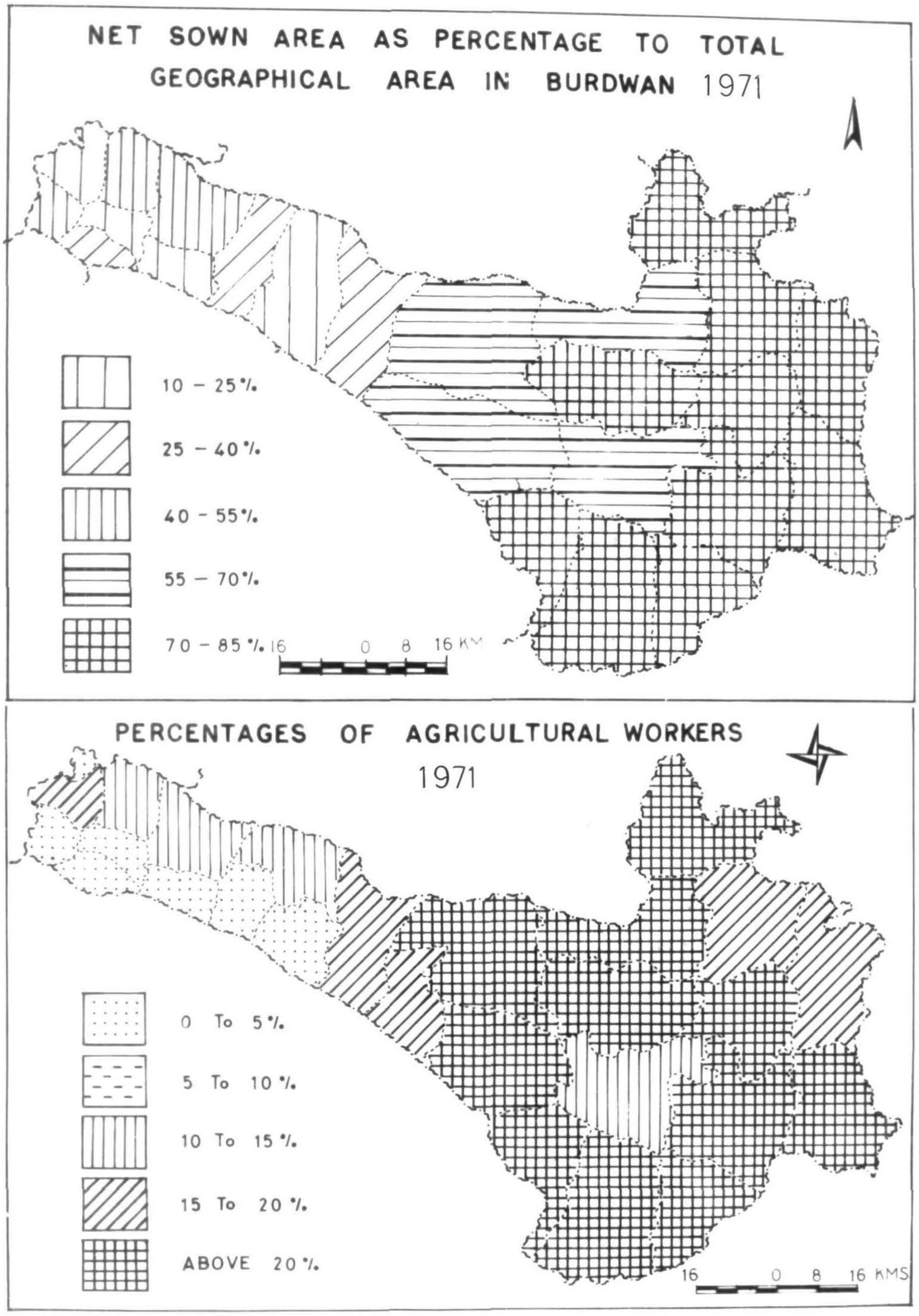

PERCENTAGES OF DOUBLE CROPPED AREA
1954-55
BELOW 1%
1 - 4%
4 - 7%
7 - 10%
ABOVE 10%
1971-72
0 - 15%
15 - 30%
30 - 45%
45 - 60%
ABOVE 60%
KMS 16 8 0 8 16

Fig. No. 48

The double cropped areas of 1954-55 and 1971-72 are shown in Figure (Figure No. 48 ). The double cropped area or area sown more than once has increased several times all over the district after 1954-55. The area under irrigation has increased as well as acreage of Boro crop. As a result double cropped area has increased several times within two decades in the central and eastern parts of the district. In 1954-55, only Jamalpur and Purbasthali P.S. produced much more double crop than Galsi, Memari, Khandaghosh, Mangolkote, Ketugram, Katwa and Kalna P.S. The rest of the district had very little acreage under double crop during that period. But after the introduction of high yielding varieties of crops in 1967-68, the area under double crop has increased. In the district, during 1971-72, it is seen that Memari, Galsi, Burdwan and Jamalpur P.S. are more progressive areas. They respond more with various inputs in comparison to Kalna, Katwa, Raina, Bhatar, Kanksa, Ketugram, Monteswar, Purbasthali and Khandaghosh. There are several factors behind the various responsive capacity of the police stations. The map (Fig. 49) represents the percentages of net sown area to total geographical area. The police stations (Salanpur, Raniganj, Asansol, Andal, Hirapur and Kanksa) of western part of the district cover less percentages of net sown area than the central part of the district. The eastern part of the district enjoys higher percentages of net sown area, where the agricultural conditions are favourable.



NET SOWN AREA AS PERCENTAGE TO TOTAL GEOGRAPHICAL AREA IN BURDWAN 1971
10 – 25 %
25 – 40 %
40 – 55 %
55 – 70 %
70 – 85 %
16 0 8 16 KM
PERCENTAGES OF AGRICULTURAL WORKERS 1971
0 To 5 %
5 To 10 %
10 To 15 %
15 To 20 %
ABOVE 20 %
16 0 8 16 KMS


Fig. No. 49

The major portion of the eastern part of the district grows more or less high yielding varieties of Boro paddy. But there is a number of serious obstacles to the widespread cultivation of the high yielding varieties of paddy in Burdwan district. The topography of the land is generally unsuitable during the main cropping season. Most of the areas are at medium or low levels of elevation and there are no means of regulating the flow of water to farmers' fields. Asansol and Durgapur subdivision was at one time a wilderness of forests and jungles, but the culturable lands have now been almost entirely reclaimed and turned into good cultivated lands.

From the methodology of land use development[3], it is seen that land use development of 1965-66 of Burdwan district is 9.35 per cent. Land use development of 1975-76 is 42.40 per cent. Therefore, change in land use from 1965-66 to 1975-76 is 353.5 per cent.

Land use development of Burdwan in 1965-66 = $LUD^x$

$$LUD^x = \frac{G^x}{N^x} - 1 \times 100$$

($G^x$ = Gross cultivated area) both for 1965-66
($N^x$ = Net cultivated area)

$$= \frac{551407.5}{504265.5} - 1 \times 100 \quad \therefore \ LUB^x = 9.35 \text{ per cent}$$

Land use development of Burdwan in 1975-76 = $LUD^y$

$$LUD^y = \frac{G^y}{N^y} - 1 \times 100 \text{ (For 1975-76)}$$

$$= \frac{648344}{455281} - 1 \times 100$$

$\therefore$ <u>$LUD^y$ = 42.40 per cent</u>

Change in land use development $= \dfrac{LUD^y - LUD^x}{LUD^x} \times 100$

$$= \frac{42.40-9.35}{9.35} \times 100$$

= 353.5 per cent.

$\therefore$ Change in Land use from 1965-66 to 1975-76 in the district of Burdwan is 353.5 per cent.

It is a great change in land use development. The utilisation of land more than once, i.e. multiple cropping practices has made for progressive land use system. From the foregoing account it may be said that change in land use is not uniform all over the district. It varies spatially due to unfavourable topographical, climatological and socio-economic condition of the district.

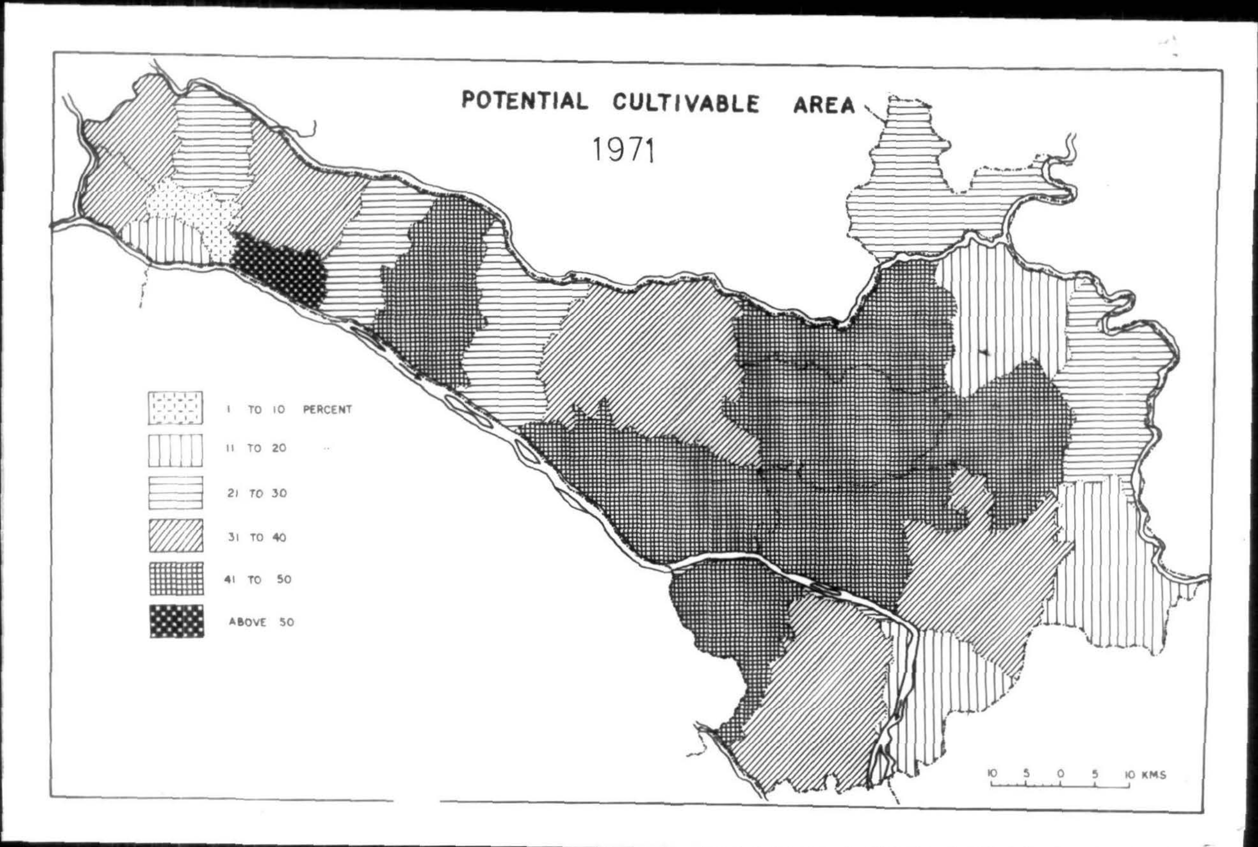
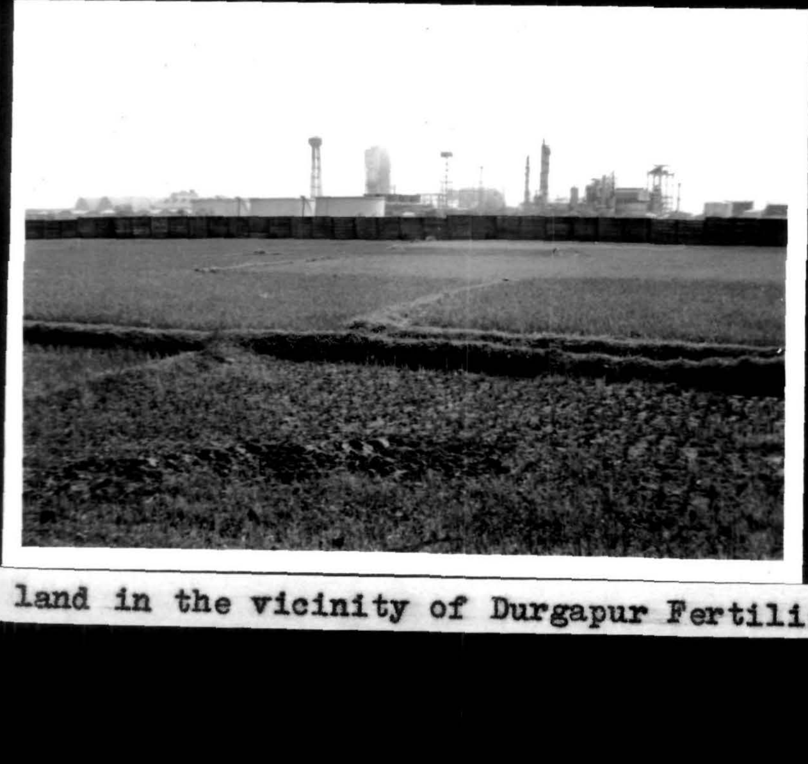



Fig. No. 50



Agricultural land in the vicinity of Durgapur Fertiliser Factory.

The map (Fig. 50 ) of "potential cultivable land"[4] expresses the agricultural potentiality of the police stations. The gross cultivated land is directly related with the potential cultivable land. The potential cultivable land is high in the police stations Raniganj and Faridpur. There are vast cultivable waste fallow lands. Raniganj and Faridpur P.S. show the highest potentiality of agricultural land use. A few police stations such as Jamalpur, Kalna and Katwa have less potentiality due to more cultivated area and Hirapur, Asansol have less potentiality, because more lands are occupied by factories, roads and settlements. "In the interest of a balanced development of the economy it is essential to ensure a balanced land use".[5]

The spatial distribution of agricultural workers deserves attention. The total population in the district is 3,916,174 among them 2076210 males and 1839964 females. Total agricultural workers in the district is 599478, i.e. 27.40 per cent to total workers of the district of which 24.23 per cent cultivators and 30.58 per cent agricultural labourers. The figure 49 shows that police stations of Durgapur, Andal, Raniganj, Asansol, Hirapur, Kulti and Chittaranjan have less than 5 per cent of agricultural workers. The police stations of Ausgram, Galsi, Khandaghosh, Raina, Jamalpur,

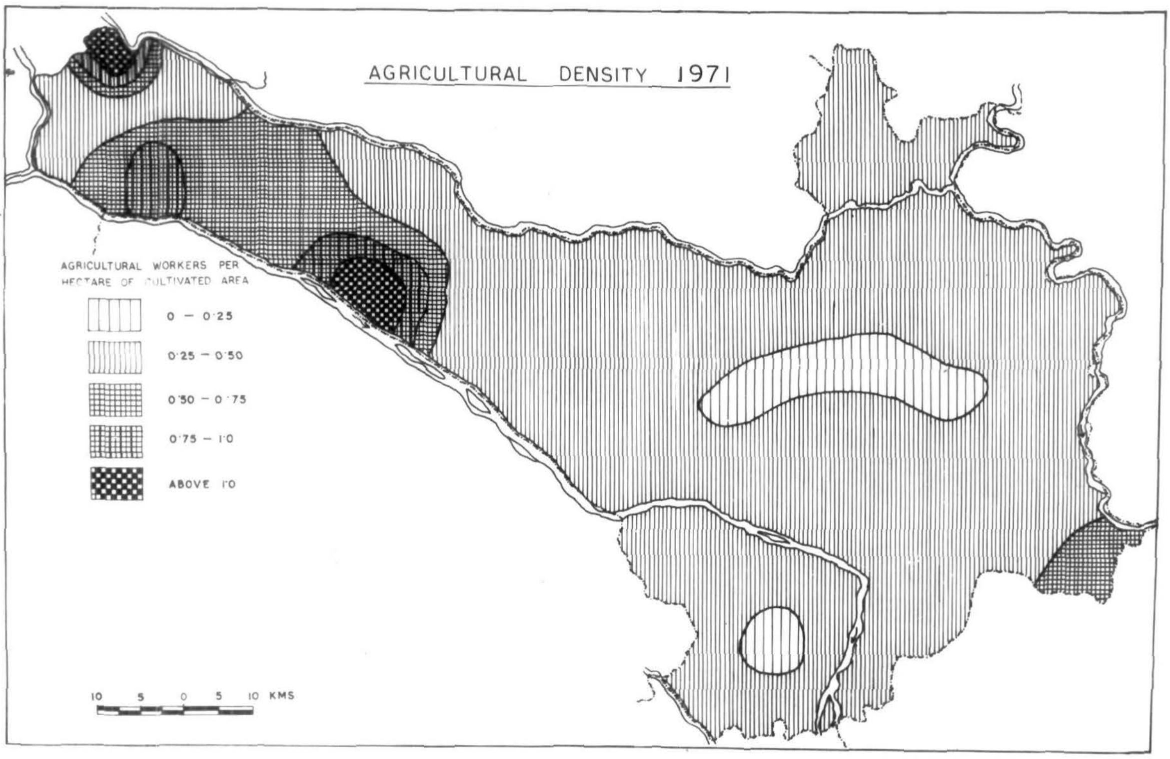

AGRICULTURAL DENSITY 1971
AGRICULTURAL WORKERS PER
HECTARE OF CULTIVATED AREA
0 — 0·25
0·25 — 0·50
0·50 — 0·75
0·75 — 1·0
ABOVE 1·0
10 5 0 5 10 KMS

Fig. No. 51

Memari, Bhatar, Mongalkote, Ketugram, Monteswar and Kalna have more than 20 per cent of agricultural workers. The percentage of agricultural workers to total population of the rest of the police stations of the district lies between 5 to 20 per cent. The distribution of agricultural workers is uneven in the district due to spatial variation of intensity of cultivation. The agricultural workers in the district is largely concentrated in the eastern part and in the rural areas of the western part. In the western police stations, a large number of people depend on mining, factories, and in the eastern police stations of the district a larger section of the people depend on agriculture for their livelihood partly because of industrial backwardness of the areas concerned and partly because of favourable climato-edaphic conditions.

Agricultural density Map (Fig. 51 ) i.e. agricultural workers per cultivated area represents that more workers are engaged per unit of cultivated land. Where the pressure of land is more the value of agricultural density is high. The highest agricultural density can be observed in Chittaranjan and Durgapur P.S., next comes Hirapur, Asansol, Jamuria, Raniganj and Andal. The agricultural density in Monteswar, Raina and Bhatar P.S. is low. The rest of the district shows

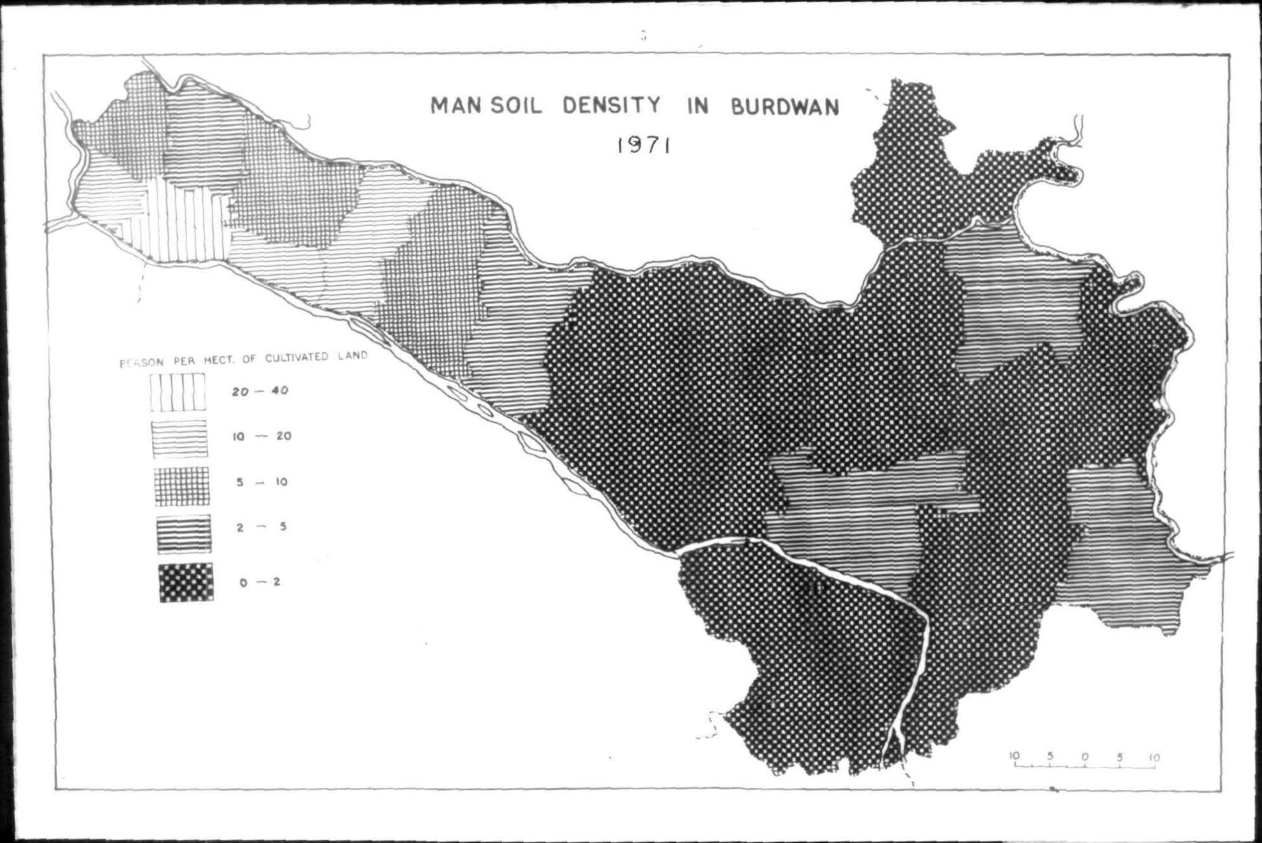

MAN SOIL DENSITY IN BURDWAN
1971
PERSON PER HECT. OF CULTIVATED LAND
20 — 40
10 — 20
5 — 10
2 — 5
0 — 2
10 5 0 5 10

Fig. No. 52

more or less low density. It is clear from the map that density is low in industrial zones i.e. western part of the district. The vast lands of central and eastern part of the district are utilized as cultivated lands.

"Man-soil density"[6] (Fig. 52 ) is just the opposite to agricultural density. It expresses how many people are engaged per unit of cultivated land. Man-soil density is high throughout the western part of the district. In Salanpur, Kulti, Hirapur, Asansol, Barabani, Jamuria, Ranigunj, Andal and Faridpur more people are directly or indirectly engaged in small area of cultivated lands. But in the eastern part of the district all the people are wholly engaged in large areas of cultivated lands. The pressure of man on cultivated land varies from unit to unit. The higher density is due to the large population size and less cultivable land in the respective unit. There is great pressure of food production on a unit of land over the western part of the district. But in central and eastern part of the district the lower man-soil density is due to availability of more cultivable land in relation to population size.

Progress in agriculture in the district is uneven and patchy. The productivity is more dependent on recent technological and institutional factors than on land capability.

"The institutional factors were neglected in pre-independence period and gave rise to an outmoded land system which inhibited agricultural growth".[7] There is a vast scope for increase of crop yields through use of scientific methods of production. Some increase in the area under cultivation may be possible through reclamation of waste lands by water management, irrigation and other methods.

Subdivision of holding and fragmentation of land :

In the district small and fragmented land holdings is a major cause of backwardness. Before 1950-51, 50 per cent of the lands belonged to the land owning class, zaminders and intermediaries, who did not cultivate the lands themselves. Since the beginning of the five year plans attention had been given to set right these imbalances by bringing in tenancy reforms. Fragmentation of holding hinders agricultural progress and it interferes with the full utilization of land. The major portion of net sown area under the holding sizes of 10-20 hectares. The table[8] shows the number of holdings reporting irrigation and area irrigated by size class of holdings.

Table 3

| Serial No. | Size Class (Hectares) | Net area sown (Hectares) | Irrigated area (Hectares) |
|---|---|---|---|
| 1. | Below 0.5 | 21587 | 13209 |
| 2. | 0.5 - 1.0 | 42046 | 24554 |
| 3. | 1.0 - 2.0 | 91255 | 57211 |
| 4. | 2.0 - 3.0 | 83100 | 52286 |
| 5. | 3.0 - 4.0 | 43710 | 29263 |
| 6. | 4.0 - 5.0 | 35095 | 22261 |
| 7. | 5.0 - 10.0 | 44272 | 29478 |
| 8. | 10.0 - 20.0 | 2590 | 1766 |
| 9. | 20.0 - 30.0 | 98 | 84 |

[Source : World Agricultural Census, 1970-71, West Bengal ]

Size of holdings also varies over space and time over the district. Fragmentation of land is more acute in the western part than in other parts of the district. The value of many of the small holdings is reduced by fragmentation. The agricultural production becomes low with the small size of land holding. It is necessary to consolidate the small holdings together for better yield. It is very essential to

put a large proportion of the land into crops that respond best to heavier applications of variable resources, especially labour and fertilizer to increase yields per acre. Small holdings, besides involving waste of land, are uneconomic units for the use of capital, wastage of labour, cattle power resulting in low production of crop. IADP officers are of the view that the overwhelming majority of farming families in Burdwan district are either completely landless or operate uneconomic holdings of less than 3 acres. One-third of all agricultural households belong to poor labour families. About 50 per cent of the land is cultivated under share cropping arrangements. Share-croppers rarely use optimum fertilizer, pesticides and irrigation due to lack of finance. The owner cultivates his land with proper care in his own interest. Amit Bhaduri argues that "the share cropping system is, at least as he observed it in West Bengal, an obstacle to technical change. He concludes that semi-feudal production relations operate as a barrier to the introduction of improved technology".[9] There is a difference of opinion regarding the relation between the size of holding and yield per acre. A.M.Khusro[10] and C.H.Hanumantha Rao[11] have tried to show an inverse relationship between size of holding and yield per acre. On the other hand Ashok Rudra[12] and A.P.Rao[13] have found that, yield per acre remains constant irrespective of differences in size of farms. In my opinion based on field

study, there is a direct relationship upto a certain level between the size of holding and yield per acre i.e. yield rate increases with the increase of size of holding. The small patchy land should be consolidated into a big holding and cultivated in a mechanised way. The productivity of land increases with proper technological methods.

Trend in agricultural production and yield rate :

Before Independence the Government did not give sufficient thought to agricultural production. After Independence it decided that low agricultural production is a major problem in a densely populated country, so that in 1950-51 the Government attempted to solve such major problems. During the First Five-Year Plan it was considered that agricultural programmes involving improved seeds, irrigation, manures and fertilisers, machinery and implements and plant protection etc. be implemented with top priority, so as to ensure the stability of the economy as a whole. In the Second Five Year plan agricultural programmes were intended to provide adequate food to support a growing population. The various programmes of co-operative development, which had been undertaken and was given greater emphasis in the Third Plan were intended to build up the necessary institutional framework for rapid economic development in rural areas. In the Fourth Five-Year

TREND IN PRODUCTION OF CROPS

(a) BY THE MOVING AVERAGE METHOD & (b) BY THE METHOD OF LEAST SQUARES

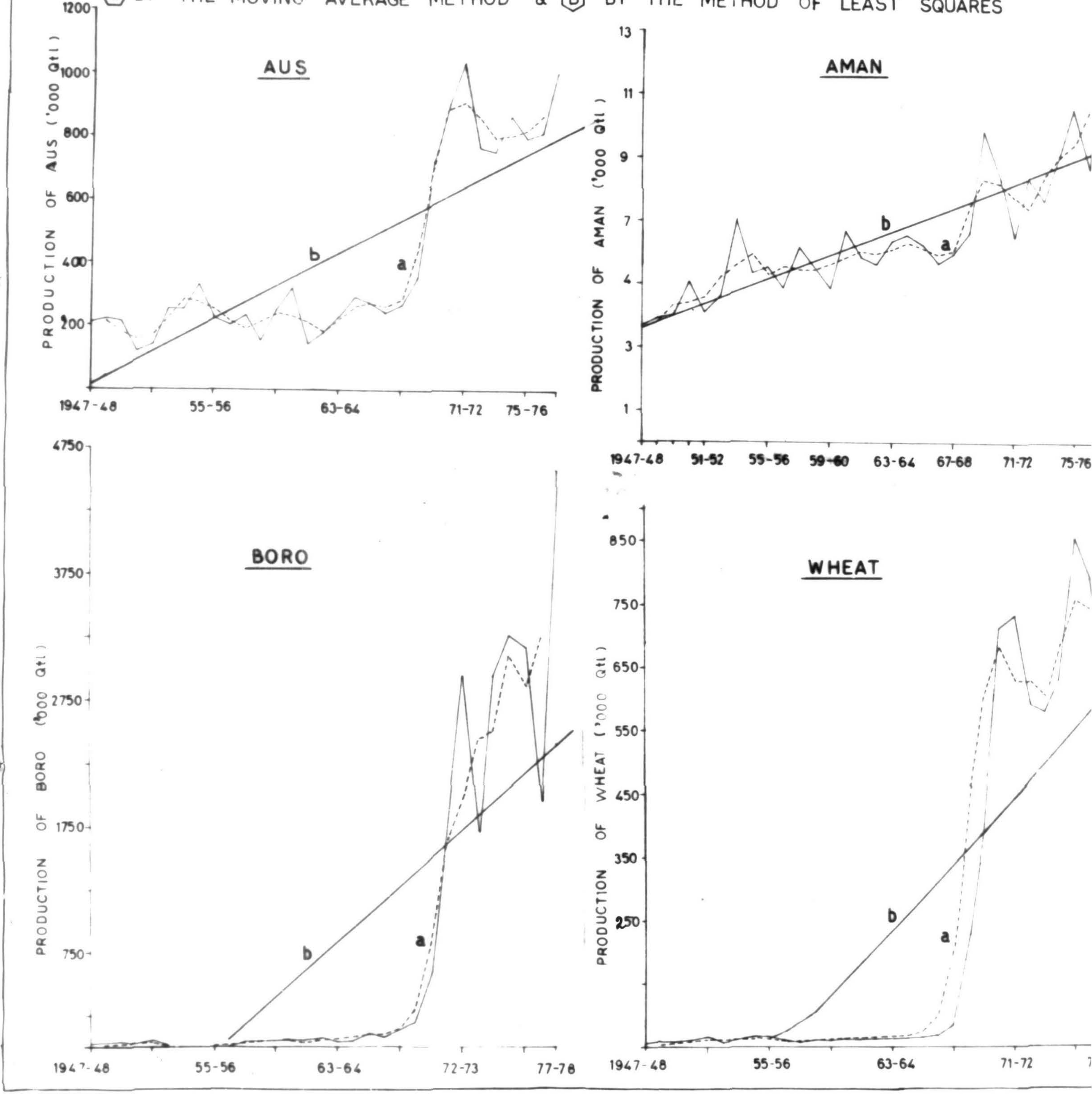



Fig. No. 5

Plan the propagation of various high yielding varieties over fairly large areas was taken up as a full-fledged programme. In the Fifth Plan the broad objectives were growth and stability of food production through a significant increase in the yield of crops per unit of area and time and also improvement in the quality and yield of export crops. The most recent advancement in agriculture is the evolution and introduction of high yielding varieties of different crops which has rendered possible increased crop production.

Figure (Fig. 53 ) illustrates the production of Aman and Aus increases gradually though fluctuations are present. In the figure it is shown that production trend of Aman and Aus increases with fluctuation. After the introduction of HYV, there is a little improvement of Aman production and large improvement of Aus production while in case of Boro and wheat both the crops are fully dependent upon irrigation and technology. Before 1967-68, the production was very low or nothing due to lack of proper care and insufficient winter irrigation. In 1967-68, IADP started intensive cultivation of principal crops (Aman, Aus, Boro and Wheat). That is why the production of Boro and Wheat increases abruptly with fluctuation. The canal, tank (irrigation) also depends upon rainfall. Fluctuations in production of all crops take place due to weather uncertainty. The drought years record low production of all

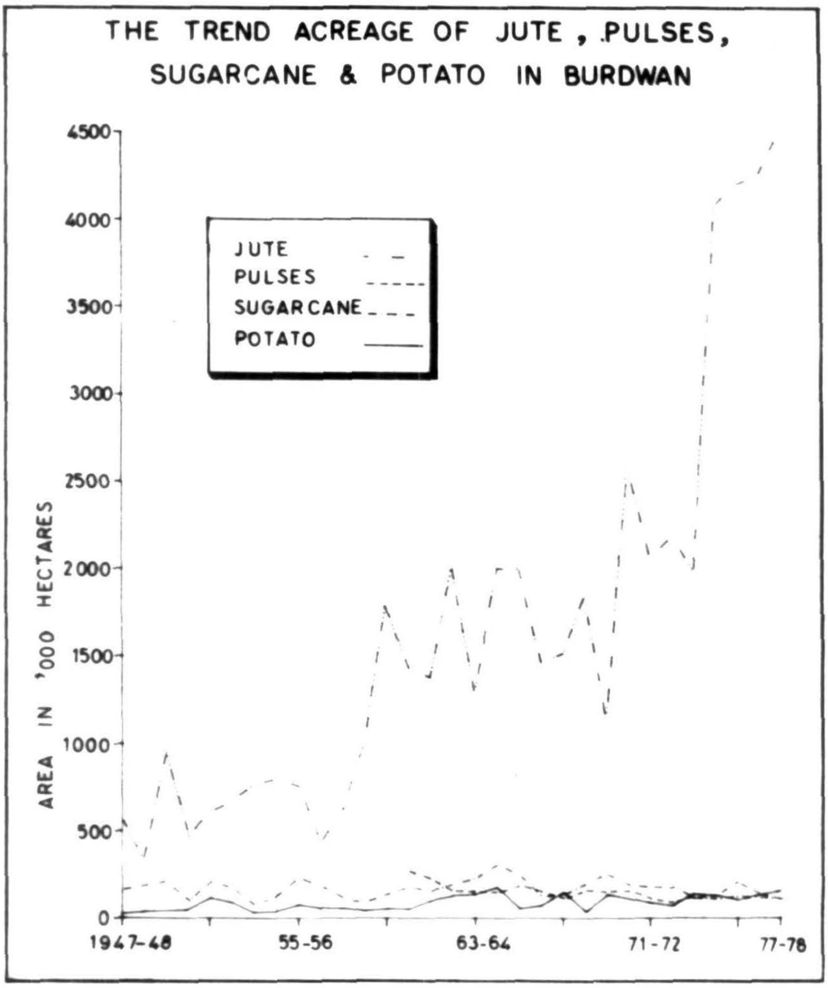

THE TREND ACREAGE OF JUTE, PULSES, SUGARCANE & POTATO IN BURDWAN
JUTE
PULSES
SUGARCANE
POTATO
AREA IN '000 HECTARES
4500
4000
3500
3000
2500
2000
1500
1000
500
0
1947-48
55-56
63-64
71-72
77-78

Fig. No. 54

crops. In some parts of the district HYV seeds of Boro are cultivated. Boro was cultivated in 1950-51, at Katwa P.S. and wheat at Ketugram and Galsi P.S. But after 1970-71 both the crops were produced all over the district, specially in the eastern part. In 1950-51 there was a large production of Aus, in Ausgram, Memari, Purbasthali, Jamuria and Barabani. During that period Raina, Galsi, Ausgram, Bhatar, Burdwan, Memari, Mongalkote, Ketugram, Katwa, Kalna and Monteswar i.e. eastern part of the district produced a large amount of Aman paddy, because the cultivation of Aman was fully dependent upon monsoonal rain and it was produced to some extent with care and the farmers were also more habituated in cultivating that crops. In case of other major crops (Kharif pulses, Rabi pulses, Potato, Sugarcane, Jute Oilseed etc.) the Figure (Fig. 54 ) shows that during 1947-48 to 1977-78, the acreage of sugarcane declined gradually into half, because it is a time consuming crop. The acreage of oilseed, jute, potato, Kharif pulses and Rabi pulses increased gradually during the 30 years between 1947 - 1977 with great fluctuations. The pulses data upto 1960 are not available. There is no systematic trend in the cultivation of that crop. These crops are fully dependent upon availability of water, land, energy of the farmers and other useful requirements. The production of the above crops increased gradually though there is a

declining trend of sugarcane acreage. That means the yield rate of the crops increase with variable fluctuations. It is very essential, to remove such various fluctuations and maintain a stable growing trend as agricultural production. The agricultural instability is also related with climatic instability. In fifth and sixth decades if the farmers produced a good yield of paddy, then they were less interested about cultivation of secondary crops (e.g. jute, potato, oilseed, sugarcane, pulses and other crops). In some years when the farmers cannot produce paddy or wheat as a second crop specially in winter due to lack of water, they produce jute, sugarcane, potato, pulses and oilseeds etc. But during the seventies the cultivators are very much interested in producing double or triple crops within a year if the climates were favourable. Now-a-days the cultivation of double or triple crops are limited within a few police stations. The IADP officers should take particular care about the cultivation of these crops in all the police stations of the district.

<u>Conclusion</u> : It is quite possible that through the application of scientific techniques of production, the diversification of agriculture and bringing land improvements, a remarkable increase in production may be achieved. The agricultural production may be raised on a large scale through

the adoption of co-operative joint farming system. Co-operative farming is the only solution for higher agricultural efficiency. The consolidation of fragments of land holdings into compact areas is an important aspect of land policy for both operational economy and production benefits. "The land holdings of small and marginal farmers and the land distributed to the landless should be consolidated in compact blocks to facilitate the concentration of public investment in irrigation and land development exclusively for the benefit of weaker sections".[14] In most parts of the country there is scope for further improvement of land utilization, it is also applicable in the district.

To conclude, attention should be given for bringing all available land under multiple cropping by consolidation of the same and by increasing irrigation facilities in the dry season. It is essential to ensure the immediate supply of high quality seeds and other inputs to meet the needs of the farmers for higher productivity. Each and every farmer should get adequate agricultural credit from the nationalised banks and co-operatives and that in time and according to his requirements. "Regarding the nature of the change itself, the stand taken by the Council is that under given conditions of soil, climate and relative prices of different crops, the farmers should grow those crops that would bring the highest possible return per unit of land cultivated".[15]

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# CHAPTER - VI

## CROPPING PATTERN IN BURDWAN DISTRICT

**Introduction :** To solve the food problem of India the most suitable strategy seems to be to increase the production per unit area per unit time, because the scope for bringing more areas under the plough is very much limited and already our country has almost reached the limit of physical frontiers in cultivation. Since Independence, we have made considerable progress in total agricultural production but the productivity per acre has not shown as much increase as was expected. In recent years the agricultural planning has taken a good turn and high yielding varieties of seeds, fertilisers, pesticides etc. are attracting the attention of scientists, planners and farmers. The main goals of agricultural policy are to ensure intensive utilisation of land, create widespread and productive employment of it and reduce economic disparity.

According to some agricultural economists, cropping pattern means the proportion of area under various crops at a given point of time. Cropping pattern is determined by the spread of the crop expressed as percentage of the total area of important crops, though it is not necessary that the area under cultivation and cropping efficiency will go together. After centuries of experience, the cropping patterns as

evolved by farmers are not found to be necessarily the most efficient in respect of use of land and other resources. In the past these cropping patterns were based on the principle of self-sufficiency in all commodities in a village, where means of communication were very poor and marketing facilities were very much limited - cropping pattern means both the time and space sequence of crops. It includes identification of the most efficient crops of the region considered as homogeneous soil and climatic belt. The cropping pattern changes with the improvement in technology and economic factors.

Under the social and economic environment which has maintained continuity with the past, the farmers follow farming practices adjusting them to the various risks and uncertainties. In general, weather and natural factors are the main sources of uncertainty. The cropping system is diversified within the limited scope offered by the seasons. The whole system of production is adjusted to the climatic conditions and to a great extent, to the food habits and consumption patterns evolved out of them. Recently the injection of new techniques into the agricultural production system has been continuous in the development programmes, but the rate of progress has been very slow. This may be partly due to the conservatism of the farmers but the

conditions which influence decision making for a change have hardly been favourable.

Due to diversity in physiography, soil, climate, economic and social set up, the district of Burdwan produces a large number of crops. An isolated study of any of these crops gives only a partial picture of its integrated network of agricultural land utilization. Therefore, it is necessary to study the whole picture of agricultural land utilization, cropping pattern and crop rotations of the district. "Regarding the nature of the change itself, the stand taken by the National Council is that under given conditions of soil, climate and relative prices of different crops, the farmers should grow those crops that would bring the highest possible return per unit of land cultivated. This, the council feels, is in the best interest of the farmers because each of them is an independent entrepreneur who should aim at maximising his return from the land".[1] The object of this paper is to focus attention upon the need for good land use planning with proper cropping practices.

## Factors that influence the cropping pattern in Burdwan

It is generally accepted that any single factor cannot influence the crop yield. A combination of different factors taken together determine the crop yield. Cropping pattern means

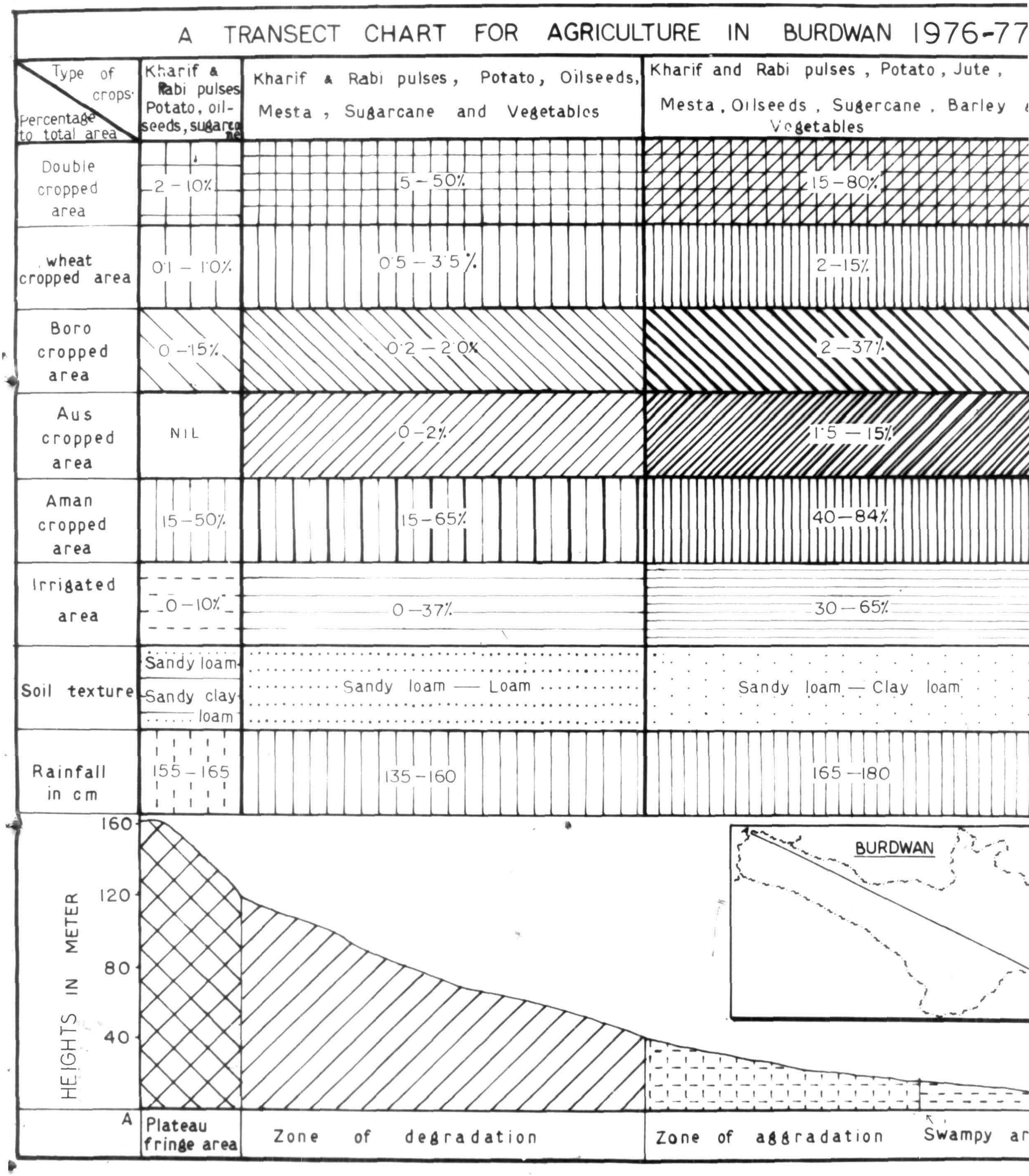

A TRANSECT CHART FOR AGRICULTURE IN BURDWAN 1976-77
Type of crops
Percentage to total area
Kharif & Rabi pulses Potato, oil-seeds, sugarcane
Kharif & Rabi pulses, Potato, Oilseeds, Mesta, Sugarcane and Vegetables
Kharif and Rabi pulses, Potato, Jute, Mesta, Oilseeds, Sugercane, Barley
Vegetables
Double cropped area
2 – 10%
5 – 50%
15 – 80%
wheat cropped area
0·1 – 1·0%
0·5 – 3·5%
2 – 15%
Boro cropped area
0 – 15%
0·2 – 2·0%
2 – 37%
Aus cropped area
NIL
0 – 2%
1·5 – 15%
Aman cropped area
15 – 50%
15 – 65%
40 – 84%
Irrigated area
0 – 10%
0 – 37%
30 – 65%
Soil texture
Sandy loam
Sandy clay loam
Sandy loam — Loam
Sandy loam — Clay loam
Rainfall in cm
155 – 165
135 – 160
165 – 180
HEIGHTS IN METER
160
120
80
40
A
BURDWAN
Plateau fringe area
Zone of degradation
Zone of aggradation
Swampy ar

Fig. No. 5

most efficient use of land and other resources and no cropping pattern can be good for all times to come. An efficient cropping pattern must ensure maximum profitable use of land, fertilizer, irrigation and other inputs. The present cropping pattern offers some alternative plans for the farmer to maximise production per unit area and per unit time.

The district produces different types of crops under different soils and climatic conditions. Paddy is the principal crop in the district. Due to the greatest importance of paddy among crops in the district, secondary crops occupy a proportionately lower percentage of the net sown area. The acreage of all the crops is also partly dependent upon physiography and climate. The spatial variation of crops is due to the above factors and socio-economic factors are the other ones. The 'Transect chart' of the district clearly explains that the vast plain land in the eastern part of the district, is suitable for agricultural production from physical point of view. The Agricultural Transect (Fig. 55) is drawn by following the method of Johnson, B.L.C.[2] according to a line from north western to south eastern part of the district. The agricultural transect chart illustrates all the spatial characteristics of the district. Physiographically the section (NW-SE) is classified into three broad divisions, such as (a) Plateau fringe area, (b) zone

of degradation and (c) zone of aggradation. The zone of aggradation is also categorised into (i) Plain area and (ii) Swampy area. All the above classifications are based upon distribution of contour and drainage.

The annual rainfall varies from 155 to 165 cm in the plateau fringe area, 135 to 160 cm in the zone of degradation and highest rainfall i.e. 165 to 180 cm in the zone of aggradation. The broad classification of soil texture varies from sandy loam to sandy clay loam in the section 'a'. Sandy loam to loam in the section 'b' and sandy loam to clay loam in section 'c'. The percentages of irrigated area are the lowest (0-10%) in the zone 'a' and highest (30-65%) in the zone 'c' and intermediate irrigated area is the zone 'b'. The net cultivated area as well as percentages of acreage of different crops i.e. Aus, Aman, Boro and wheat vary directly with the amount of the aforesaid agricultural conditions. In the zone of plateau fringe, the percentages of Aman cropped area vary from 15 to 50%, Aus cropped area is nil, Boro and wheat cropped areas respectively vary from 0 to 0.15 per cent and 0.1 to 1 per cent. Most of the lands are monocultural and completely dependent upon rainfall. The percentage of double cropped area to net sown area ranges from 2 to 10. Various other types of crops such as, Kharif and Rabi pulses, potato, oilseeds, sugarcane, vegetables etc. are cultivated

in little quantity on water available area. The zone of degradation lies in the intermediate position in all respects that is to say, percentages of Aman, Aus, Boro, wheat and double cropped area vary respectively from 15 to 65, 0 to 2 0.2 to 2, 0.5 to 3.5 and 5 to 50. Pulses, potato, oilseeds, mesta, sugarcane and vegetables etc. are cultivated as double or triple crops in this zone. The zone of aggradation is the most productive land, where the percentages of Aman, Aus Boro, wheat and double cropped area respectively vary from 40 to 84, 1.5 to 15, 2 to 3.7, 2 to 15 and 15 to 80. Various other types of crops, such as pulses, potato, sugarcane, jute, mesta, oilseed, barley and vegetables are grown in this zone for local consumption.

Cropping patterns depend on soil, climate, topography, irrigation, socio-economic considerations and nature of local demand. The availablity of water also determines the choice of crops. Temperature is particularly important. The amount and distribution of rainfall is very essential at the crucial period of planting or sowing. The canal and tank water supplies do not appear to be sufficient in several places. More storage structures and tanks are needed to collect the runoff water during monsoons. Besides these, underground sources should also be tapped and fitted up with power driven pumpsets where even three crops could

be raised from the same area in a year. Therefore, there is need for wise-planning of our cropping pattern with due regard to the climatic limitations. The soil fertility status of the district is high but the level of productivity is low. Such a weak relationship indicates that the productivity is dependent on recent technological and institutional factors and not on land capability. These technological factors are not properly applied in the district. The things necessary are a careful selection of soil to be irrigated, cropping patterns with appropriate mixes of high and low water stress crops, methods of irrigation adapted to soil characteristics, slope, climatic factors, minimisation of evaporation, timing of irrigation to suit crop stages, control of aquatic weeds and crop types. Nutrient demands of different crops vary. The soil nutrients have positive influence on crop production, i.e. the crop responds rationally to the potential fertility status of the soil. A new philosophy enunciated by Melsted (1954) is a philosophy of "maximum crop production per acre of land with minimum of soil deterioration".[3] Planting should be undertaken using selective fertilizer for high yielding crops. The response of these soils to nitrogen, phosphate and potash fertilizers are also good, but the appropriate quantity of the fertilizers in particular type of soil must be determined before they are actually applied.

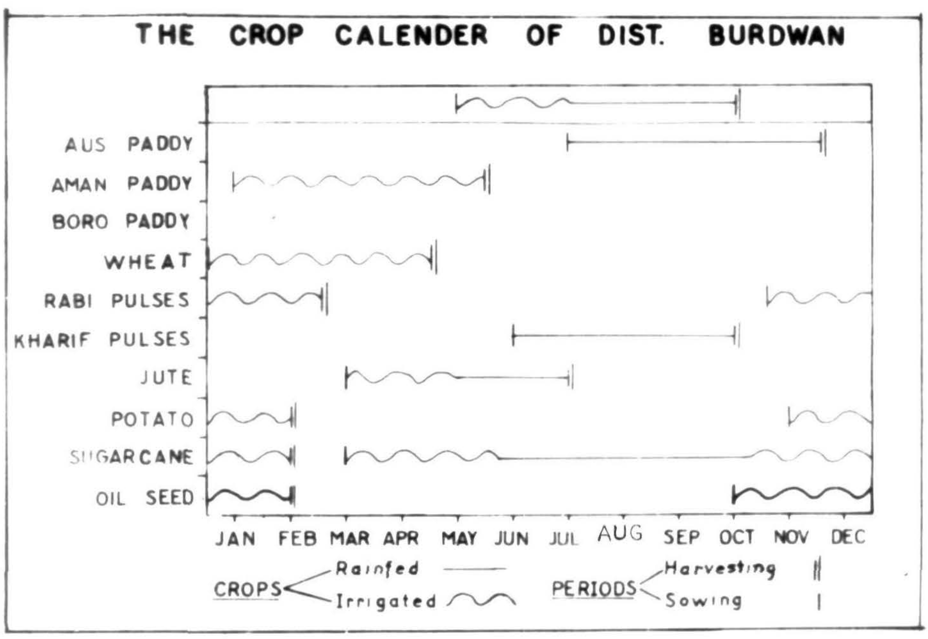
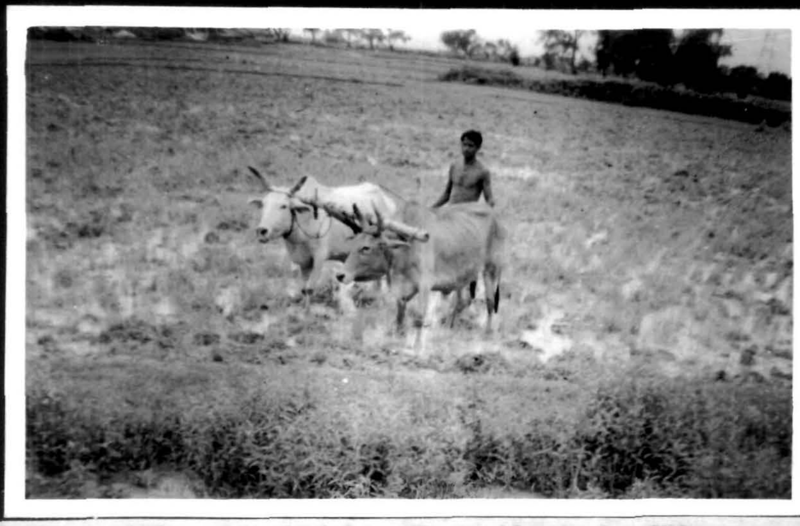

THE CROP CALENDER OF DIST. BURDWAN
AUS PADDY
AMAN PADDY
BORO PADDY
WHEAT
RABI PULSES
KHARIF PULSES
JUTE
POTATO
SUGARCANE
OIL SEED
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
CROPS
Rainfed
Irrigated
PERIODS
Harvesting
Sowing

Fig. No. 56

Monthly rainfall is unevenly distributed in time and space, being excessive in one part of the district and insufficient in the other. Monthly rainfall distribution is more important than the annual total rainfall. The insufficient and excessive amount of rainfall in the month of June delays the sowing of Kharif crops. The inadequacy of moisture in July and August results in crop failures. The rainfall in the months of September and October is important for the sowing of Rabi crops as also for the quality and yield of Kharif crops. This rainfall helps kharif crops at the period of maturing while for Rabi it provides moisture for its sowing. Heavy rainfall in October - November may delay the sowing of Rabi crops due to the excess of moisture in the soil and water logging and may cause damage to kharif crops.

The Principal crops of the district.

It has been shown that paddy is the most important crop of the district. The district produces surplus paddy over and above the quantity required for internal consumption. All the different varieties cultivated may be grouped under three primary classes distinguished from one another by marked characteristics - the Aus or autumn; the Aman or winter; and the Boro or the summer paddy. It is to be noted that silt deposited 'diara lands' are most suitable for cultivation of paddy.

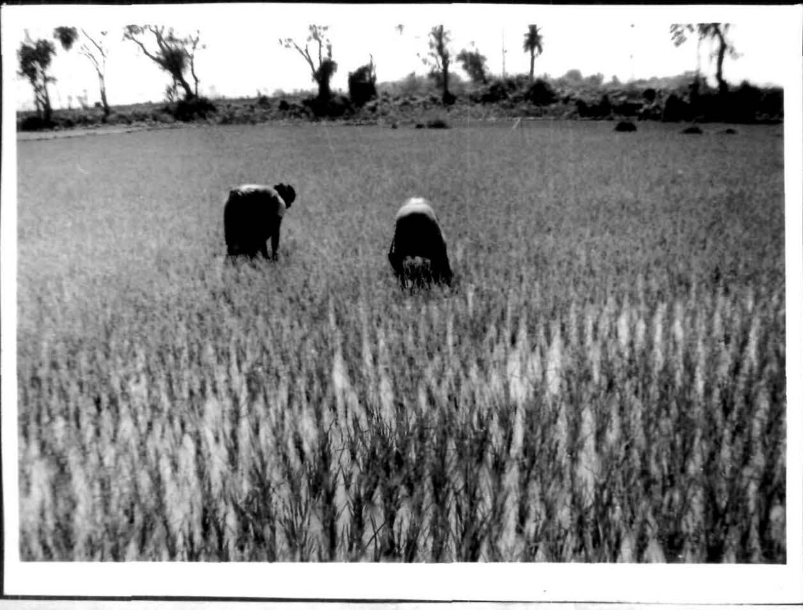


Ploughing by traditional method in Hirapur P.S.

Sowing Aman Paddy for a winter harvest

Ordinarily Aus is thought to be a coarse crop. Aus is generally sown in April-May and harvested in August-September. Aman is transplanted in July-August and harvested in November. Both the crops are grown by transplanting and require 'dhular-chas' and 'kadar chas'. Sandy loam and loamy sand soils are most suitable for Aus crop. Mostly medium level and some high lands are suitable for growing of the crop. This crop also thrives on monsoon showers and takes 4-5 months for its cultivation. Yield rate of this crop is generally lower than that of Aman. The maximum area of land is used for the cultivation of Aman. It grows well on clay loam and on clay soil and requires standing water. The crop takes a 5-6 month period for its cultivation. Low and medium level lands are suitable for growing this crop. As the crop thrives on standing water and its yield rate depends on time of transplantation, the crop is largely dependent on monsoon showers. The use of high yielding varieties of Aman has been suggested for two different periods - the Kharif period and the post Kharif period.

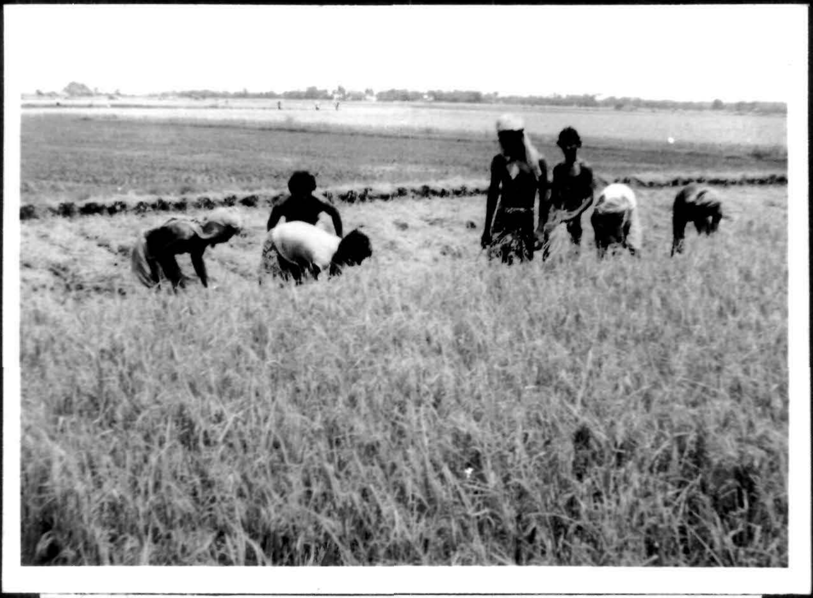
Recently there have been considerable doubts and uncertainties with regard to the yield and productivity of high yielding varieties. The high yielding varieties are usually imported varieties which have developed immunity



Freeing the field of the weeds in Ausgram P.S.

Transplantation of paddy in the land near the Damodar Main Canal in Galsi P.S.

against the usual odds. Exotic high yielding varieties viz. Taichung Nativa-I, Kalimpong-I, Tainan-3 etc. were introduced in the year 1966-67. But the performance of these varieties failed to attract good response from the farmers particularly in respect of kharif crops because of their poor grain quality and their susceptibility to diseases. Next year IR-8 was introduced and framers accepted the variety and its acreage went on increasing from year to year in Rabi season. The varieties Jaya, IR-8, Pankaj, Vijoya, Ratna were introduced later on. N.C. variety was suitable for medium and low land but failed to earn popularity due to erratic performance causing difficulties. Pankaj and IR-20 have gained popularity due to the fineness of the grain and its disease resistance. Cultivation of Boro paddy is getting importance in medium and low lying areas, requiring as it does plenty of water, and soil rich in moisture retaining capacity. Boro paddy is sown in January-February and harvested in May-June. The crop also requires sufficient sunshine and adequate water. The high yielding varieties of Boro paddy are cultivated on some areas in the district. The high yielding varieties during Boro season yield higher output per acre than the same HYV during the kharif season. This higher productivity is the result of the absence of rains during the maturing season as also the availability of strong sunlight during the



Harvesting of paddy in Burdwan P.S.

Threshing of paddy in Burdwan P.S.

day and moderate moisture in the winter nights. There are, however, various difficulties in cultivating the winter variety of Boro, scarcity of water being prominent among them. The available water in the canals being limited in the post kharif season, short supply of irrigation is a constraint of Boro cultivation. The productivity of HYV paddy is better in Rabi than in Kharif, this being due to a number of agronomic factors - such as better drying facilities, less vulnerability to pest attacks and controlled irrigation etc. The HYV shows better yields as compared to local varieties, but they are far below the optimum levels as compared to experimental data. There are a number of serious obstacles to the widespread cultivation of the high yielding varieties of paddy in Burdwan. For one thing, the toporgaphy of the land is generally unsuitable during the main Aman seasons. Moreover, the HYV paddy requires adequate water, 12-13 hours of sunlight daily to ensure optimum yields. The cultivators are unable to adapt themselves in full measure, to all the aspects of the recommended package practices necessary for the realisation of the yield potentials of the new varieties. Actually, under the conditions of Burdwan district, the best period to grow IR-8 is the dry and sunny summer season as a Boro crop.

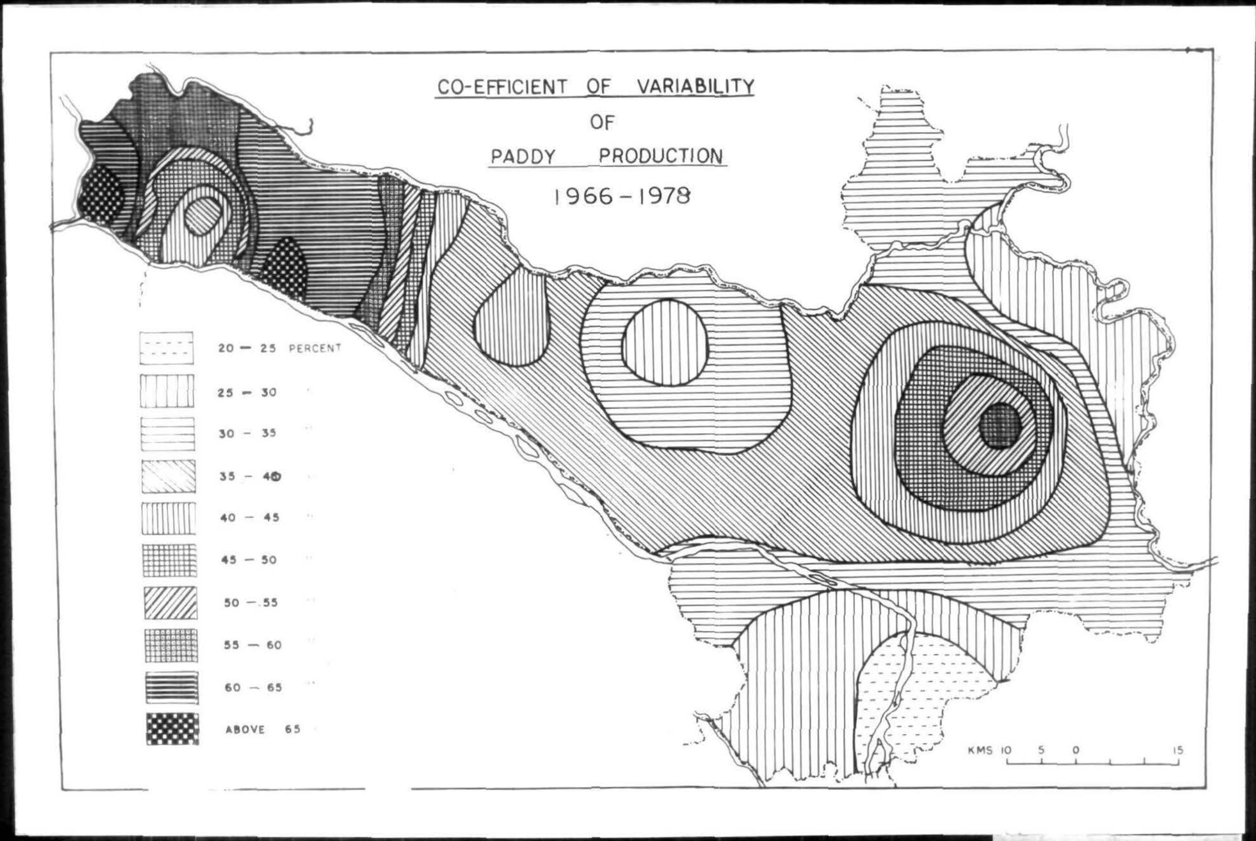
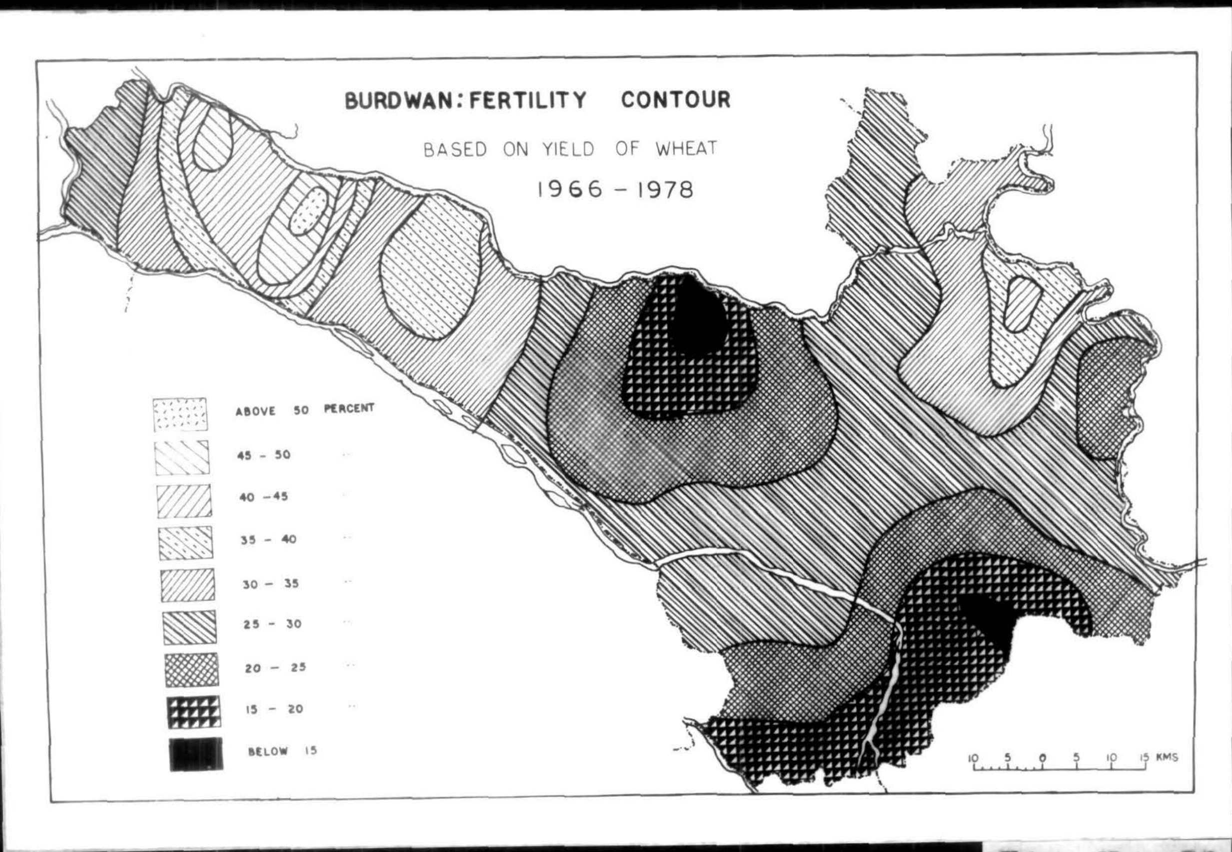

CO-EFFICIENT OF VARIABILITY
OF
PADDY PRODUCTION
1966 - 1978
20 — 25 PERCENT
25 — 30
30 — 35
35 — 40
40 — 45
45 — 50
50 — 55
55 — 60
60 — 65
ABOVE 65
KMS 10 5 0 15

Fig. No. 57

The production of paddy depends on the whims of nature. Regular and timely rainfall may assure a bumper crop, while in some years of irregular rainfall, production is badly affected by drought or flood. Paddy is the leading crop in every police stations of the district. A spatio-temporal analysis of production of paddy can be had from the Map (Fig. 57) of co-efficient of variability of paddy production. Co-efficient of variability is expressed by percentages of the ratio of standard deviation and arithmatic mean of paddy production. In this case mean and standard deviation are taken from the data of paddy production of all the police stations in the district for the 12 year period (1966-67 to 1977-78). The map illustrates that variability is greater at the western part of the district. It varies from 35 per cent to above 65 per cent in the western part. The reason behind the greater variability of paddy production is the climatic undertainty i.e. vagaries of monsoon. The requirement of water over the western part for cultivation is more than that for the eastern part because the storage water in the western part is in-sufficient and the topography slopy. In the eastern part of the district near Monteswar, Purbasthali, Bhatar, Burdwan, the co-efficient of variability varies from 25 to 60 per cent. It varies from 25 to 40 per cent near Ausgram, Mongalkote P.S. In the remaining eastern part of the district it varies from 20 to 40 per cent. The low value of C.V. of paddy production

in the eastern part indicates that water problem is not very acute there as in the other part. There are many canals in the district but they are not utilised as a timely water-supplier. "Very often the canals are ready, but not the water courses; or the water courses are ready but not the field channels. All this means that the irrigation potential is created but it is not being fully utilised to the extent that the water courses or the field channels are not ready simultaneously with canal".[4] If water is supplied to the distant plots by inundating the land in the immediate vicinity, the crops there may be damaged. The solution lies in distributing the water through pipes and by small link channels to those particular plots which need the water at any particular time.

Next to paddy, wheat is the second most important crop in Burdwan district. In the past not much attention was paid to wheat crop as it was less popular to the local farmers. After the introduction of the Third Five Year Plan, there has been a change in the cropping pattern and more area is being brought under cultivation of "Wheat can be cultivated in small plots in a scattered manner with water either from tanks, canals, beels, shallow tube wells, deep tube wells, or river lift pumps as the case may be ".[5] Loamy and clay loam soil are better suited to growth of the crop. Dry and fairly



BURDWAN: FERTILITY CONTOUR
BASED ON YIELD OF WHEAT
1966 - 1978
ABOVE 50 PERCENT
45 - 50
40 - 45
35 - 40
30 - 35
25 - 30
20 - 25
15 - 20
BELOW 15
10 5 0 5 10 15 KMS


Fig. No. 58

cold weather favours this crop. It takes 5-6 months (Dec.-Jan. to May- June) for cultivation of such a Rabi crop. Fertile and fine textured soils give higher yields of wheat. As a dry-land crop it grows best on clayey soils. Under irrigation it can be grown even on sandy soils. Since it is grown during the dry, cool, winter months, dry wheat must depend mostly on stored soil moisture. Cloudy weather during the rapidly growing stage is conducive to the development of wheat rust diseases. High yielding varieties of wheat, such as Sonalika, Kalyansona etc. are cultivated in some areas of the district. During Rabi season wheat becomes particularly important in the areas having mean seasonal temperature below 20°C.

A clear idea can be obtained from the Map (Fig. 58) of "Fertility Contour"[6] of the district. The fertility contour map is drawn by the co-efficient of variability of yield rate of wheat. In the western part we can observe the repetition of the above case i.e. co-efficient of variability varies from 25 to above 50 per cent. It is because of the climatic uncertainty and scarcity of storage water wheat is cultivated with the help of stored water, such as, tank, well, canal etc. but such storage water, depends upon the amount of rainfall. In the north eastern part, near Katwa P.S., co-efficient of variability ranges from 25 to 45

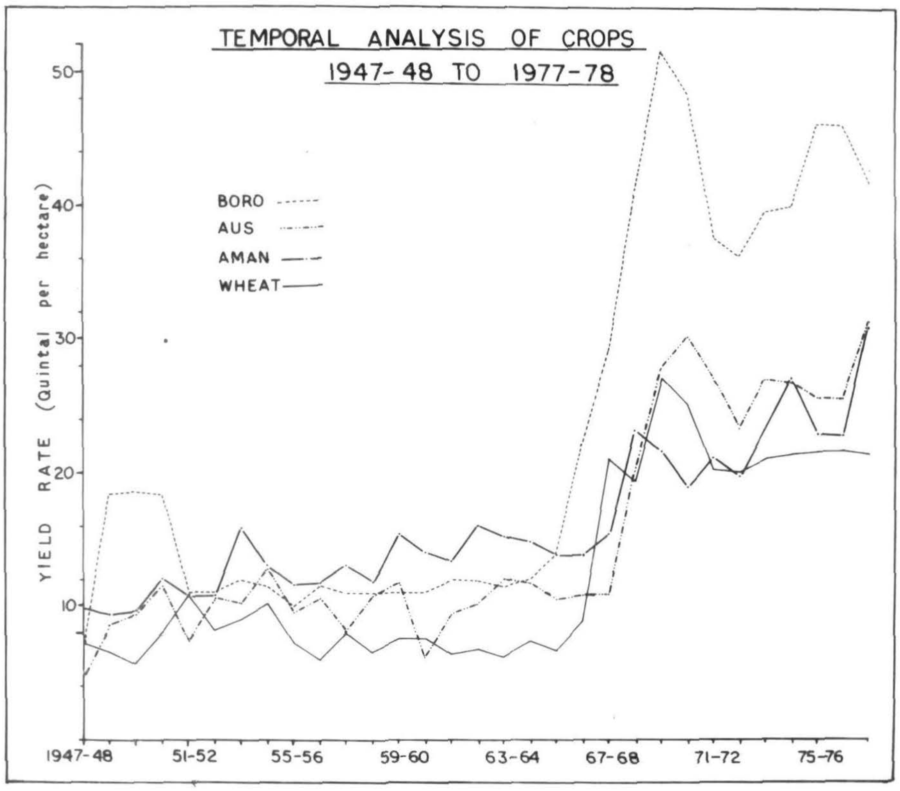

TEMPORAL ANALYSIS OF CROPS
1947-48 TO 1977-78
BORO
AUS
AMAN
WHEAT
YIELD RATE (Quintal per hectare)
50
40
30
20
10
1947-48
51-52
55-56
59-60
63-64
67-68
71-72
75-76

Fig. No. 59

per cent. This variability of yield rate of wheat varies from below 15 to 30 per cent over the whole eastern part of the district. Therefore, fertility contour is high at the eastern part of the district.

The figure shows the temporal analysis of yield rate of Aman, Aus, Boro and wheat during 1947-48 to 1977-78. The yield rates of all these crops fluctuate every year due to climatic uncertainty and socio-economic imbalances. Generally, the yield rate varies from 6 qtl/hectare to 16 quintal/hectare during 1947-48 to 1966-67. After the introduction of new technology and high yielding varieties of seeds the yield rates of all crops have increased ultimately, varying from 20 to 30 qtl/hectare for Aus, Aman, Wheat and 30 to 50 qtl/hectare only for Boro crop. The application of HYV seed in case of Boro crop being greater, the yield rate of the same is also higher, unfortunately the fluctuations are more remarkable with increasing yield rate. There is a great chance of crop damages for HYV seeds due to inadequate inputs (irrigation, fertilizer, pesticides etc.) and impact of pest diseases. After introduction of technological innovations in 1967-68, the yield rate increased for 2 or 3 years i.e. upto 1970-71. But after that period, the yield rate decreased instead of increasing though the input application gradually increased. It may be said with

SPATIAL VARIATION OF YIELD RATE OF CROPS

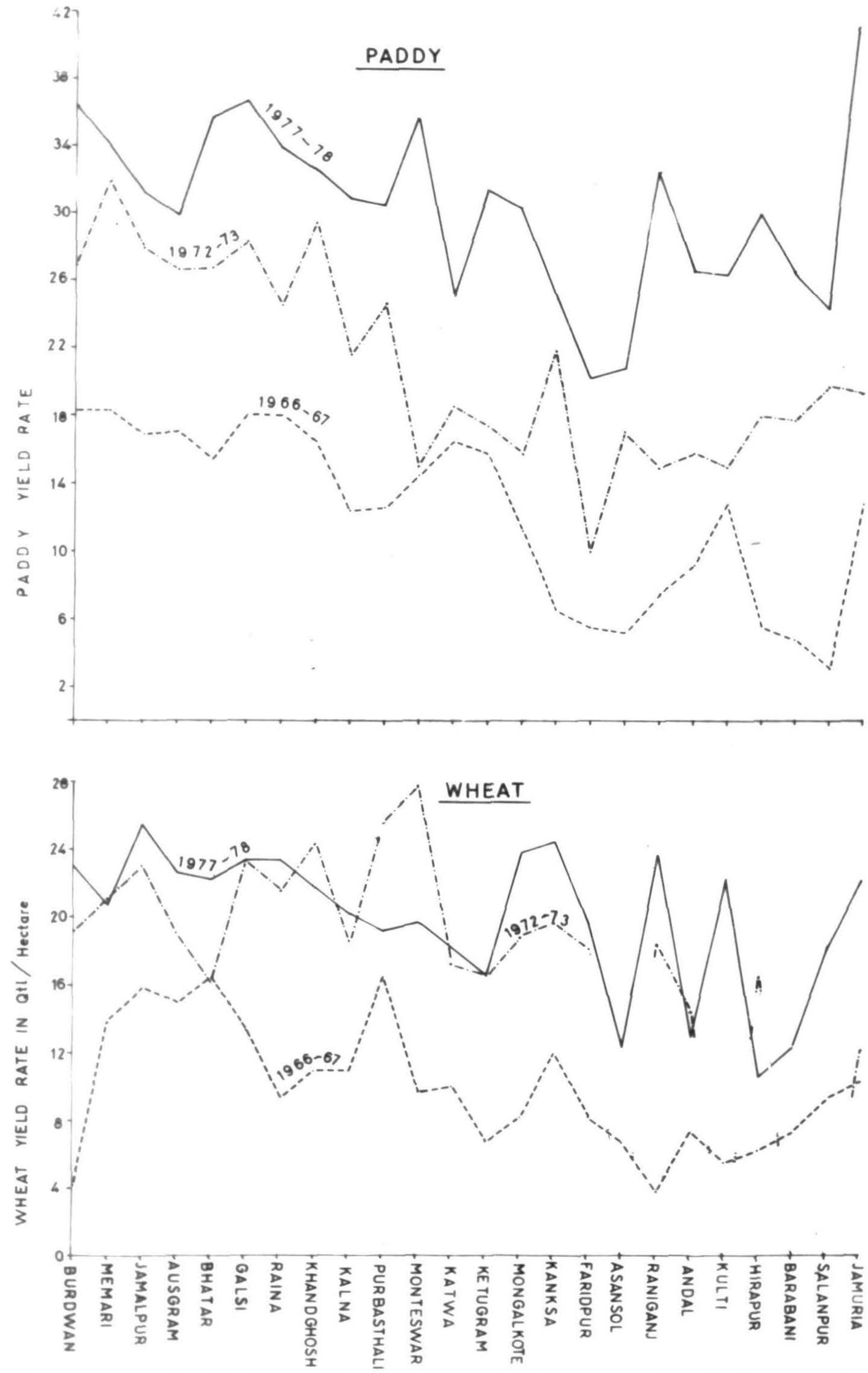



Fig. No. 60

certainty that this new method is not actually suitable in our country. The reasons for the predominance of paddy cultivation and the lack of diversification in the cropping pattern are to be found in the basic nature of the country's agrarian economy.

The spatial variation of yield rate of paddy (Fig. 60 ) illustrates that it was low in 1966-67 and high in 1977-78 with much fluctuations. In 1972-73 the yield rate of all police stations occupied intermediate position between high and low. The yield rate is more or less high throughout the eastern part of the district, as compared with the district average. The yield rate was specially high in Burdwan, Memari, Ausgram, Bhatar, Galsi, Raina, Khandaghosh, Kalna, Purbasthali, Montes-war, Katwa, Ketugram and Mongalkote during 1977-78. Generally, it is low in western part of the district, but there is a considerable amount of interpolice station variations in the degree of low yield rate of paddy. The yield rate was compara-tively high in Kulti, Jamuria during 1966-67; in Kanksa, Salanpur and Jamuria during 1972-73 and in Raniganj, Jamuria, Hirapur during 1977-78. Such a rise step by step, in the tendency of yield rate of paddy is generally due to technical innovation. The technological innovation is applied in a greater measure over the eastern part of the district. Per acre productivity is lower in the western part than in the other parts. The yield rate increases gradually due to application of HYV seeds in Rabi

season. Predominance of Aman is more marked in areas which enjoy better facilities of irrigation. Market acceptability of Aman variety is also much better. It has been observed, that when there is an opportunity to cultivate either Aman or Aus, the choice is invariably in favour of Aman because of availability of monsoon water and its high yield rate and popularity. Almost all the police stations have some plots of land under the cultivation of Aus located at somewhat lower level than the sorrounding areas. Uplands are comparatively dry on which no water logging takes place and the most determining factor is topography and soil texture. There are several police stations in which the proportion of Aus land and Aman land is higher than the district average. The Aman growing police stations are Burdwan, Memari, Ausgram, Galsi, Bhatar, Raina, Kalna, Monteswar, Katwa, and Ketugram. Local variety of Boro is being replaced by high yielding variety of Boro. The names of the police stations in which there is a greater proportion of Boro lands are Burdwan, Memari, Jamalpur, Bhatar, Galsi, Kalna Purbasthali, Monteswar and Katwa. A tactical advantage in respect of Boro cultivation is that the time for the cultivation of Boro and that for the cultivation of Aman are mutually exclusive. If water supply is assured, both can be cultivated on the same plot, one after another and that is what is done in many lands in the eastern part of the district.

The spatio-temporal analysis of yield rate of wheat (Fig. 60 ) shows that it is not cultivated in each year throughout

the district. It seems to be an alternating crop and there is much variability in yield rate of wheat. During 1966-67 the yield rate varied from 4 to 17 qtl/hectare and it is higher in Memari,Jamalpur, Ausgram, Bhatar, Galsi, Purbasthali, Kanksa and Jamuria in comparison to the district avefage. It is to be noted that the eastern part of the district is getting more facilities for wheat cultivation. During 1972-73, the yield rate of wheat was more than in the preceding periods, but wheat was not cultivated during that period in several police stations, such as Asansol, Kulti, Barabani and Salanpur. This increasing tendency of wheat cultivation is due to the impact of new technology in some areas. In Memari, Jamalpur, Galsi, Raina, Khandaghosh, Purbasthali and Monteswar the yield rate was more than that of other areas in 1972-73. In 1977-78, the yield rate did not increase from that in 1972-73, while amount of input utilisation was more in the eastern part of the district. It varied from 11 qtl/hect. in Hirapur to 25 qtl/hect. in Jamalpur. During that period the yield rate was high in some areas, such as Burdwan, Jamalpur, Ausgram, Bhatar, Galsi, Raina, Mongalkote, Kanksa, Ranigunj, Kulti and Jamuria. The Police Stations where the cultivation of wheat is on a large scale are Burdwan, Memari, Jamalpur, Bhatar, Galsi, Raina, Khandaghosh, Kalna, Purbasthali, Katwa, Ketugram and Mongalkote. The soil condition in some of the police stations has proved to be quite suitable for growing HYV wheat. The above mentioned police stations have irrigation facilities in Rabi season and there are good reasons to expect that if irrigation

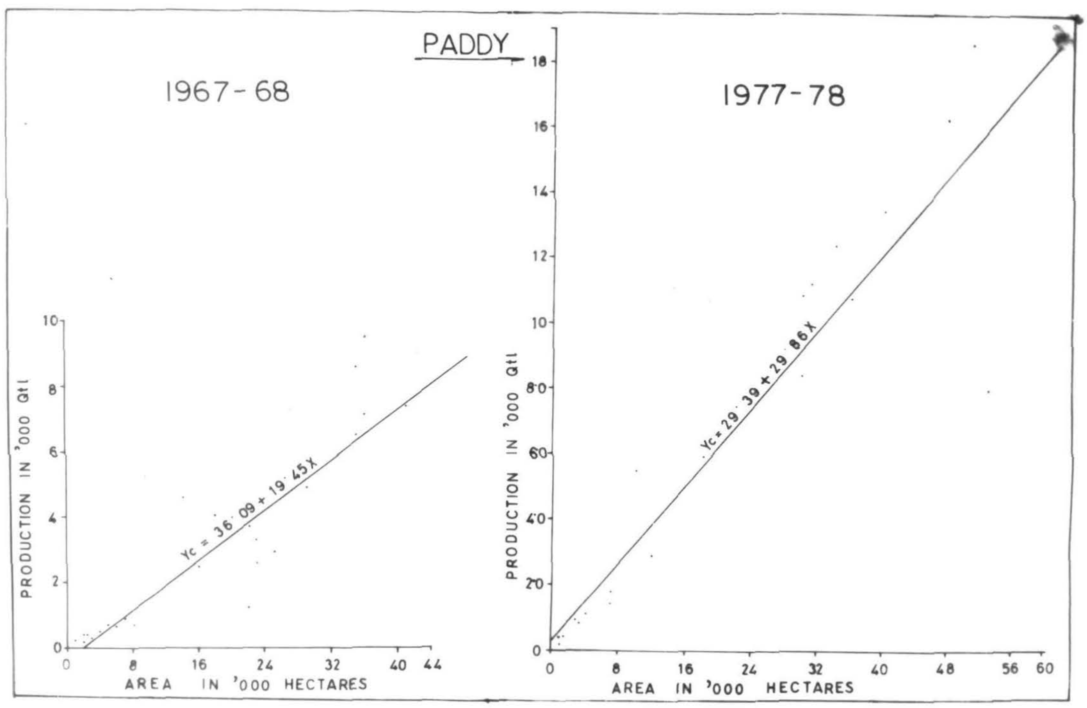



Fig. No. 61

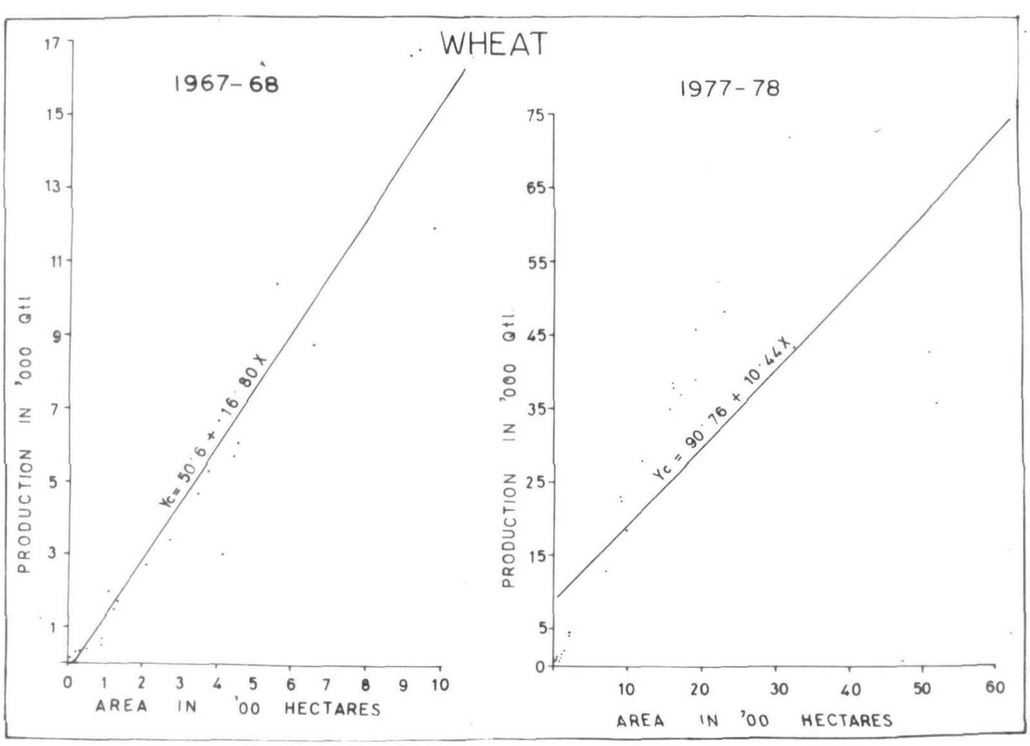



Fig. no. 62

facilities can be extended and seed for HYV made available,total acreage under wheat will increase fast.

Table 1

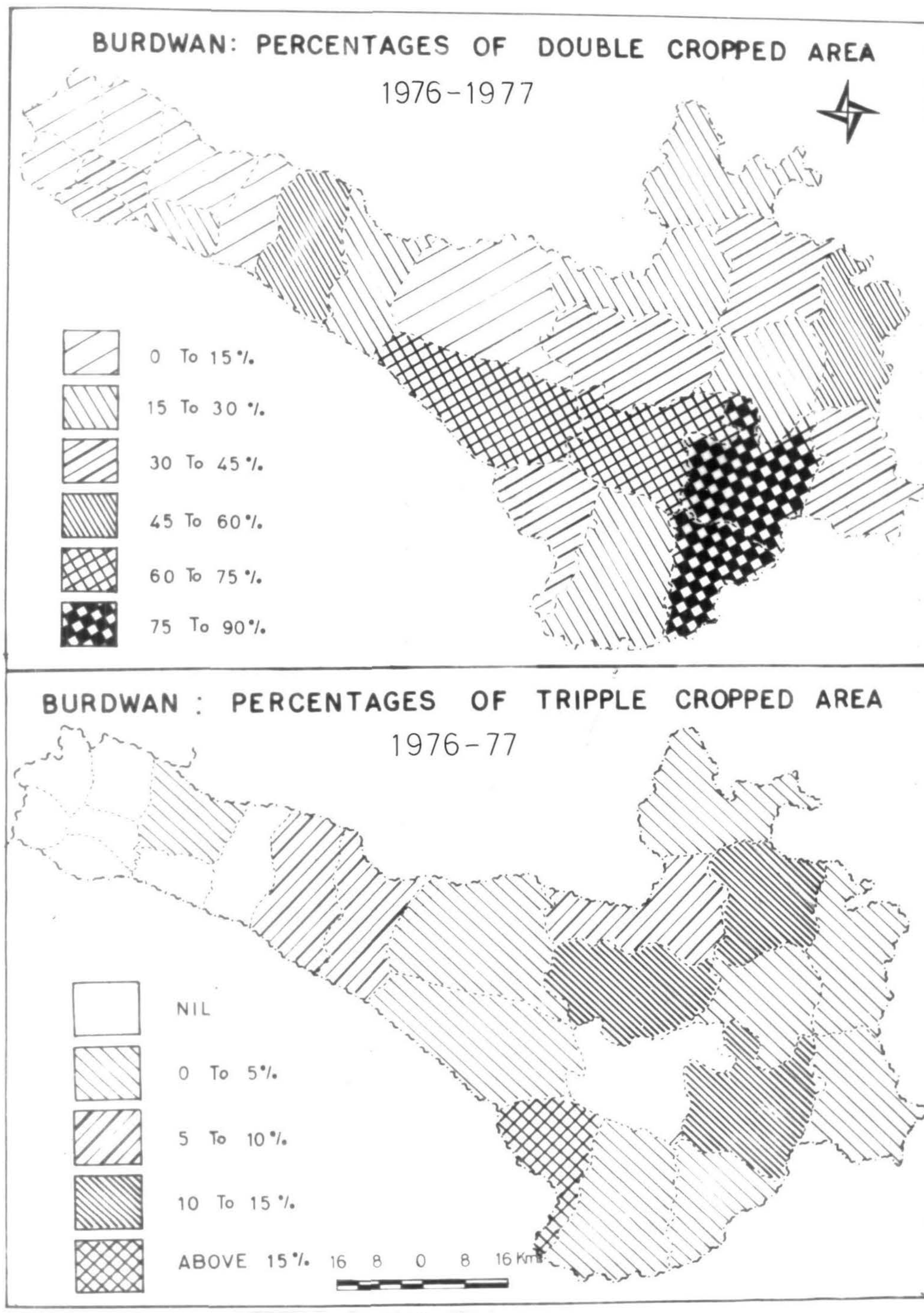
| Name of the P.S. | Paddy [Area in Hectares, production in quintals] | | | |
|---|---|---|---|---|
| | 1967-68 | | 1977-78 | |
| | Area | Production | Area | Production |
| Burdwan | 15,997 | 252,805 | 34,222 | 1,242,541 |
| Memari | 36,499 | 950,206 | 48,276 | 1,642,082 |
| Jamalpur | 29,584 | 490,161 | 27,395 | 856,397 |
| Ausgram | 41,137 | 739,222 | 36,269 | 1,077,103 |
| Bhatar | 17,688 | 406,350 | 30,415 | 1,085,042 |
| Galsi | 36,513 | 715,550 | 50,912 | 1,866,370 |
| Raina | 34,769 | 858,016 | 39,909 | 1,349,012 |
| Khandaghosh | 13,877 | 458,151 | 18,048 | 586,838 |
| Kalna | 23,084 | 324,639 | 27,945 | 862,988 |
| Purbasthali | 34,844 | 647,397 | 23,502 | 715,455 |
| Monteswar | 8,435 | 74,058 | 31,589 | 1,125,747 |
| Katwa | 22,730 | 367,304 | 53,266 | 802,643 |
| Ketugram | 25,508 | 293,652 | 26,118 | 817,377 |
| Mongalkote | 23,538 | 258,572 | 25,393 | 771,947 |
| Kanksa | 22,522 | 123,531 | 11,752 | 290,540 |
| Faridpur | 5,913 | 65,270 | 6,975 | 140,494 |
| Asansol | 2,650 | 19,504 | 1,145 | 23,728 |
| Raniganj | 5,584 | 61,578 | 1,119 | 36,385 |
| Andal | 3,481 | 28,804 | 3,580 | 94,991 |
| Kulti | 7,207 | 92,520 | 4,350 | 114,790 |
| Hirapur | 2,882 | 37,164 | 1,269 | 38,182 |
| Barabani | 1,452 | 16,847 | 6,743 | 178,371 |
| Salanpur | 5,234 | 65,707 | 3,567 | 86,964 |
| Jamuria | 4,183 | 49,778 | 10,748 | 552,767 |

Source : IADP, Agricultural Office, Burdwan.

Table 1 (contd.)

| Name of the P.S. | Wheat [Area in Hectares, production in quintals] | | | |
|---|---|---|---|---|
| | 1967-68 | | 1977-78 | |
| | Area | Production | Area | Production |
| Burdwan | 405 | 6,720 | 1207 | 27,743 |
| Memari | 928 | 16,809 | 2349 | 48,660 |
| Jamalpur | 911 | 16,785 | 911 | 23,400 |
| Ausgram | 459 | 6,141 | 1559 | 35,266 |
| Bhatar | 344 | 4,751 | 3240 | 72,000 |
| Galsi | 648 | 8,882 | 1632 | 38,003 |
| Raina | 369 | 5,338 | 1644 | 38,286 |
| Khandaghosh | 109 | 2,014 | 1701 | 37,086 |
| Kalna | 567 | 10,444 | 1903 | 38,650 |
| Purbasthali | 269 | 3,438 | 2835 | 54,950 |
| Monteswar | 134 | 1,722 | 688 | 13,600 |
| Katwa | 411 | 2,993 | 5140 | 43,245 |
| Ketugram | 972 | 11,928 | 5250 | 36,037 |
| Mongalkote | 445 | 5,742 | 1953 | 46,300 |
| Kanksa | 124 | 1,479 | 931 | 22,770 |
| Faridpur | 89 | 656 | 216 | 4,205 |
| Asansol | 14 | 78 | 73 | 900 |
| Raniganj | 35 | 259 | 41 | 976 |
| Andal | 95 | 526 | 75 | 971 |
| Kulti | 20 | 279 | 30 | 667 |
| Hirapur | 51 | 373 | 51 | 600 |
| Barabani | 28 | 234 | 81 | 1,000 |
| Salanpur | 8 | 112 | 20 | 165 |
| Jamaria | 60 | 666 | 210 | 4,665 |

Source : IADP, Agricultural Office, Burdwan.




Souree: IADP, Burdwan

Fig. No. 63

Pearsonian correlation co-efficient (r) of paddy was 0.91 in 1967-68 and 0.92 in 1977-78. In both the cases the variables are acreage and production of paddy. The regression equation, which is shown in the figure, in the case of former is $Y_c = -36.09 + 19.45x$ and in the later, $Y_c = 29.39 + 29.86x$. The trend line shows that whenever acreage increases the production also increases i.e. they are directly related.

The correlation co-efficient of wheat was 0.99 in 1967-68 and 0.73 in 1977-78. The figure illustrates that regression equation of trend line is, $Y_c = -506 + 16.80x$ in 1967-68 and $Y_c = 90.76 + 10.44x$ in 1977-78. The correlation is greater in case of the former year than the later one and the variables (acreage and production of wheat) are also directly related.

The direct relation between the variables is the normal case. If there is any dispersion between the variables i.e. requirements of cultivation are not fulfilled by sufficient input or it is in excess of the requirement, or if there is any crop damage, then the relation may vary indirectly.

There are two maps — one depicting the area under double cropping (Fig. 63 ) and the other, the area under triple cropping (Fig. 63 ). The area is expressed in percentages. The map of double cropped area indicates that the lowest acreage (below 15%) is covered by Kulti, Salanpur, Barabani, Jamuria,

Andal and Ausgram. The double cropped area varies from 15 to 30 per cent in Raniganj, Kanksa, Ketugram, Mongalkote, Monteswar, Raina and 30 to 45 per cent in Hirapur, Asansol, Khandaghosh, Bhatar, Katwa, Kalna and 45 to 60 per cent in Faridpur, Purbasthali. The percentages of double cropped area are high i.e. 60 to 90 per cent in Galsi, Burdwan, Memari and Jamalpur. It can be said without any hesitation that availability of water for the double crop is greater throughout the eastern part. Most of the police stations of that part are canal facilitated area, though the canals in their turn are dependent upon the amount of rainfall. The acreage percentages of triple cropped area range from below 10 to above 10 per cent. The area under triple cropping is nil in the police stations - Kulti, Barabani, Salanpur, Asansol, Hirapur, Ranigunj, Andal and Burdwan. The triple cropped area varies from 0-10 per cent in Faridpur, Kanksa, Ausgram, Galsi, Ketugram, Mongalkote, Kalna, Purbasthali, Monteswar, Jamalpur, Raina to above 10 per cent in Bhatar, Khandaghosh, Memari and Katwa. The western part of the district is completely devoid of area under triple cropping due to scarcity of water. In general, it is very low in the eastern part of the district. The area of double or multiple cropping in the district is not provided with the facility of irrigation water. The farmers are not enthusiastic about the production of various types of crops from the same land. The farmers do not know how to utilise the plots of land with the little amount of available water.

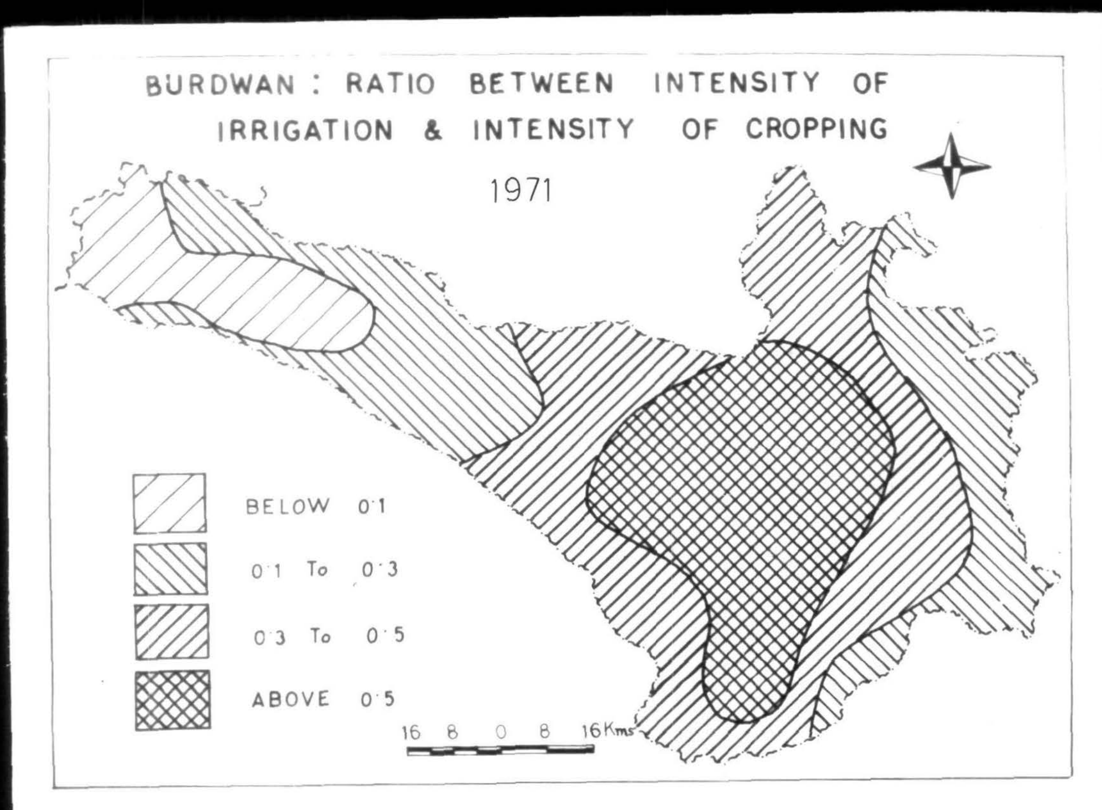

BURDWAN : RATIO BETWEEN INTENSITY OF
IRRIGATION & INTENSITY OF CROPPING
1971
BELOW 0·1
0·1 To 0·3
0·3 To 0·5
ABOVE 0·5
16 8 0 8 16 Kms

Fig. No. 64

Table 2

| Name of the P.S. | Intensity of irrigation | Intensity of cropping | Ratio (r) Intensity of irrigation / Intensity of cropping |
|---|---|---|---|
| Salanpur | 0 | 117.09 | 0 |
| Jamuria | 0 | 113.73 | 0 |
| Asansol | 1.93 | 134.50 | .01 |
| Andal | 2.0 | 105.56 | .02 |
| Kulti | 5.81 | 103.48 | .05 |
| Ranigunj | 11.58 | 126.10 | .09 |
| Hirapur | 14.53 | 135.64 | .11 |
| Purbasthali | 18.04 | 151.51 | .12 |
| Faridpur | 22.78 | 154.46 | .15 |
| Kanksa | 21.05 | 133.45 | .16 |
| Barabani | 19.96 | 102.67 | .19 |
| Jamalpur | 44.96 | 179.75 | .25 |
| Kalna | 41.22 | 144.46 | .28 |
| Katwa | 44.27 | 151.56 | .29 |
| Khandaghosh | 62.98 | 162.01 | .39 |
| Memari | 77.34 | 173.86 | .44 |
| Ausgram | 51.91 | 114.27 | .45 |
| Ketugram | 56.83 | 124.74 | .46 |
| Monteswar | 62.26 | 123.33 | .50 |
| Galsi | 86.10 | 170.67 | .50 |
| Burdwan | 86.56 | 167.12 | .52 |
| Raina | 62.45 | 118.60 | .53 |
| Mongalkote | 71.58 | 124.16 | .57 |
| Bhatar | 84.85 | 138.22 | .61 |

Source : 1971 District Census Handbook, Burdwan.

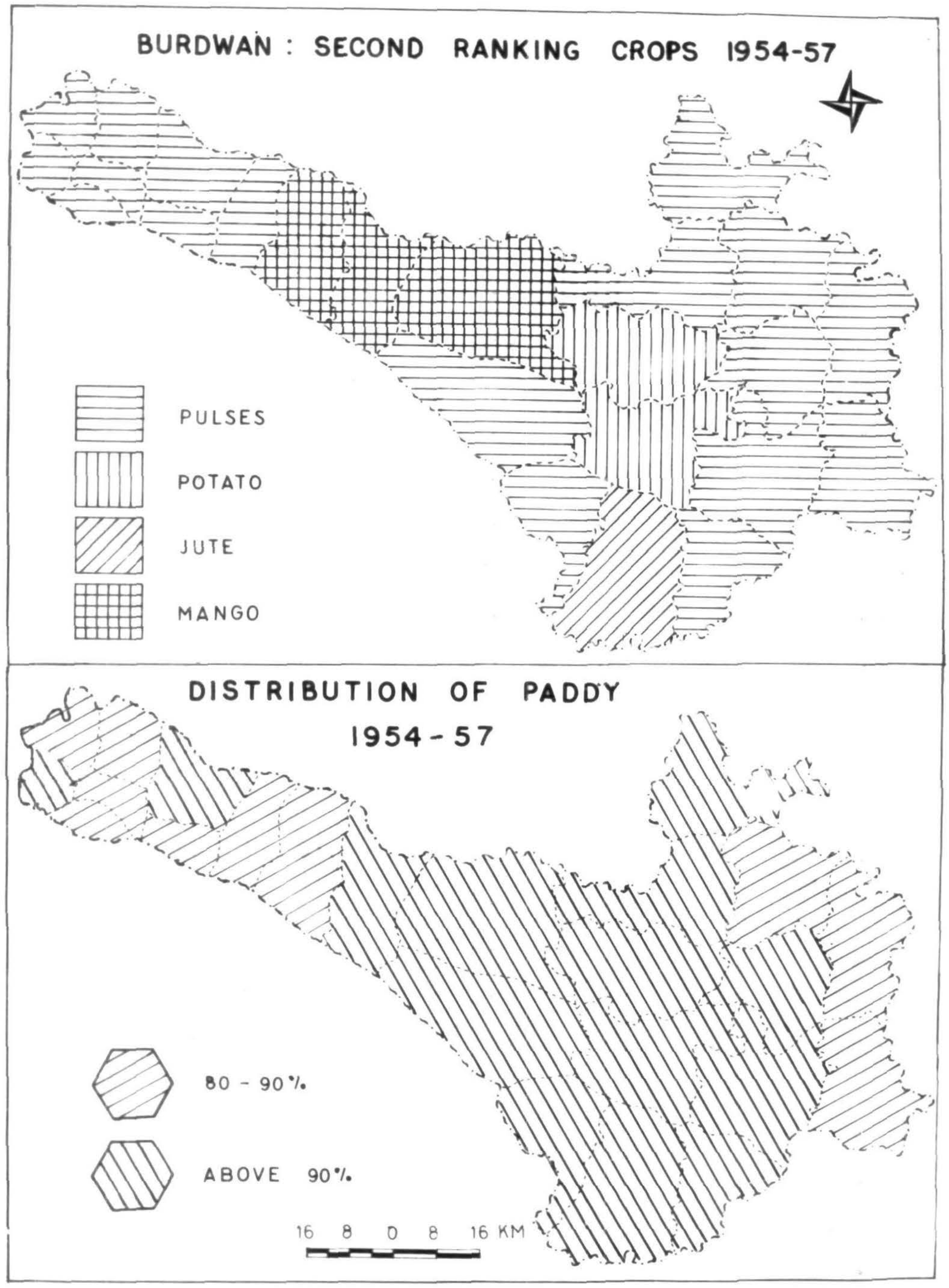

BURDWAN : SECOND RANKING CROPS 1954-57
PULSES
POTATO
JUTE
MANGO
DISTRIBUTION OF PADDY
1954 - 57
80 - 90 %
ABOVE 90 %
16 8 0 8 16 KM

Fig. No. 65

The relationship between intensity of irrigation and intensity of cropping can be recognised from the map of "Ratio between intensity of irrigation and intensity of cropping".[7] The isopleths are drawn along the same values of ratio between intensity of irrigation and intensity of cropping. In the extreme western part (Salanpur, Kulti, Hirapur, Asansol, Raniguni, south of Jamuria and middle of Andal) the value of simple ratio is below 0.1. In the western part (Faridpur, Kanksa, West of Ausgram) and along some portion of the river bank of the Damodar, Ajay and Bhagirathi in the district -- the ratio varies from 0.1 to 0.3. The intensity of cropping is more significantly influenced by intensity of irrigation. If the ratios are high intensity of irrigation is more than intensity of cropping. In my study the result is less significant, as the ratio lies between 0 - 0.61.

Secondary crops in the district

In the district potatoes are cultivated widely in the eastern part and some amount of sugarcane, jute, pulses, oilseeds, barley etc. are also grown in various parts of the district. With reference to the paper of "Agriculture of West Bengal by A.K.Basu"[8] it can be analysed from the Map (Fig. 65) that acreage of paddy in the district was more than 80% during 1954-57 varying from 80 to 90% in Salanpur, Barabani, Hirapur, Asansol, Ranigunj, Andal, Katwa, Purbasthali and Kalna, to

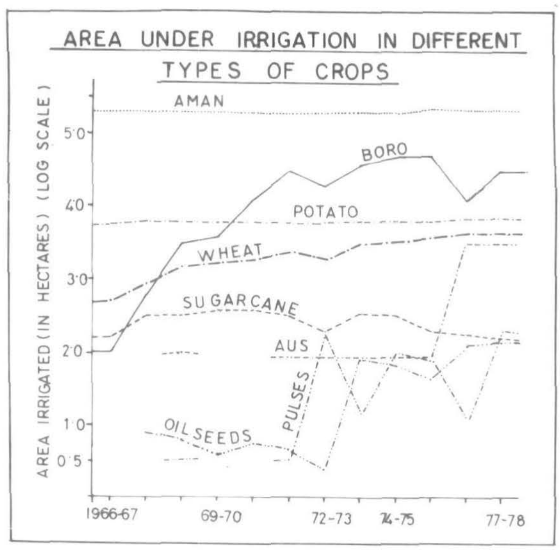
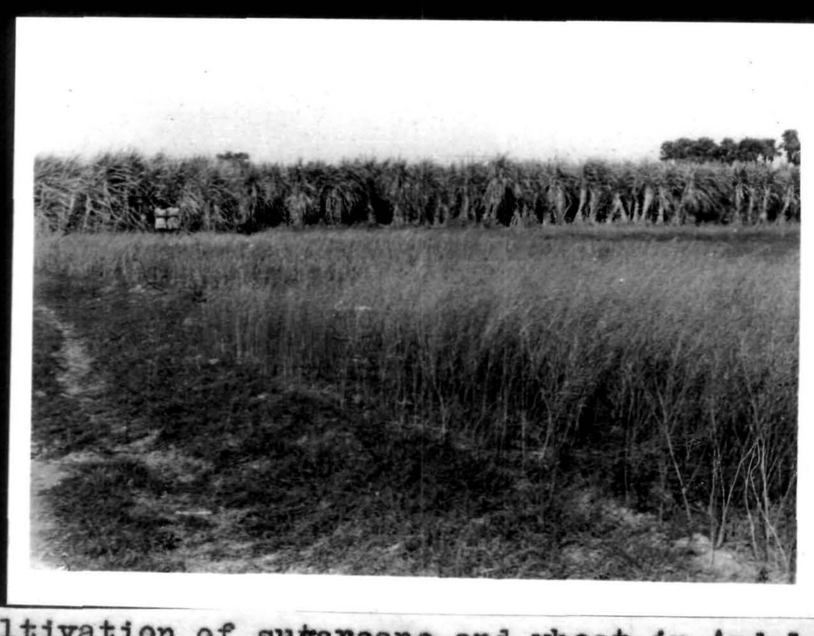

AREA UNDER IRRIGATION IN DIFFERENT TYPES OF CROPS
AREA IRRIGATED (IN HECTARES) (LOG SCALE)
AMAN
BORO
POTATO
WHEAT
SUGARCANE
AUS
PULSES
OIL SEEDS
5·0
4·0
3·0
2·0
1·0
0·5
1966-67
69-70
72-73
74-75
77-78

Fig. No. 66

above 90% in the rest of the police stations of the district. Jute was second ranking crop in Raina; Potato was second ranking crop in Burdwan, Bhatar, Kanksa, Ausgram; Mango in Faridpur, Kanksa, Ausgram and Pulses in the rest of the police stations of the district. We can analyse the third and fourth ranking crops of the district during that period. As regards third ranking crops, Jute was grown in Purbasthali and Kalna; Pulses in Faridpur and Kulti; Sugarcane in Ketugram and Katwa; Potato in Ausgram, Galsi and Memari; Mango in Barabani, Asansol, Andal, Bhatar, Burdwan and others in Salanpur, Jamuria, Kanksa, Monteswar, Khandaghosh, Raina, Jamalpur, Considered as the fourth ranking crop, Mango was cultivated in Khandaghosh, Jamalpur, Memari, Purbasthali; Sugarcane in Mongalkote and Bhatar; Potato in Kalna and vegetables in the remaining police stations of the district.

Jute is one of the most important cash crops cultivated in a limited areas of the district. The soil condition is not suitable for jute crop in many parts. High temperature, high rainfall and loamy to sandy soils are suitable to jute ecology. This is a good practice of crop rotation that jute is associated with the gram and pulses as jute is a soil exhausting crop and pulses are soil replenishing ones. There are certain factors which inhibit the extension of jute cultivation over wide areas in the district. The topography,

Cultivation of potato and other vegetables during winter in Kalna P.S.



Cultivation of sugarcane and wheat in Andal P.S.

composition of soil and availability of water in most of the police stations are more suitable for growing of paddy than jute. It is essential to cultivate staple food rather than nonfood grains in the district of a poor country.

Potato has become a popular cash crop in parts of the district for different reasons : availability of irrigation facilities, suitable soil, presence of progressive farmers in a part of the district, ability of big farmers to invest money for this highly remunerative cash crop, cold storage facilities, good roads for transhipment of the product to different consuming centres. It is grown in all the police stations of Burdwan Sadar, Kalna and Katwa sub-divisions. In Durgapur and Asansol sub-divisions, its cultivation is insignificant due to the unsuitability of soil and lack of water. This tuber crop grows in sandy loam soil which has moisture retentive capacity. This Rabi crop cannot withstand waterlogging and requires moderate temperature. The area under potato crop can be substantially increased with increased supply of improved seed, fertilizer, extended irrigation facilities and scientific rotation of different crops.

Like potato, sugarcane is both a cash crop as well as a crop used for domestic and local consumption. Cultivation of sugarcane has declined in recent years perhaps because of lower yield rate of sugarcane and comparatively longer period

of cultivation and increased preference for paddy. It is grown on high lands with considerable irrigation facilities. It requires a long humid season during the period of growth and an average temperature varying from 15° to 25°C. It is cultivated in Andal and some police stations of eastern part of the district. The production of sugarcane has gradually declined and the area under it diminished because the labourers gradually lose interest in it for low profit returns.

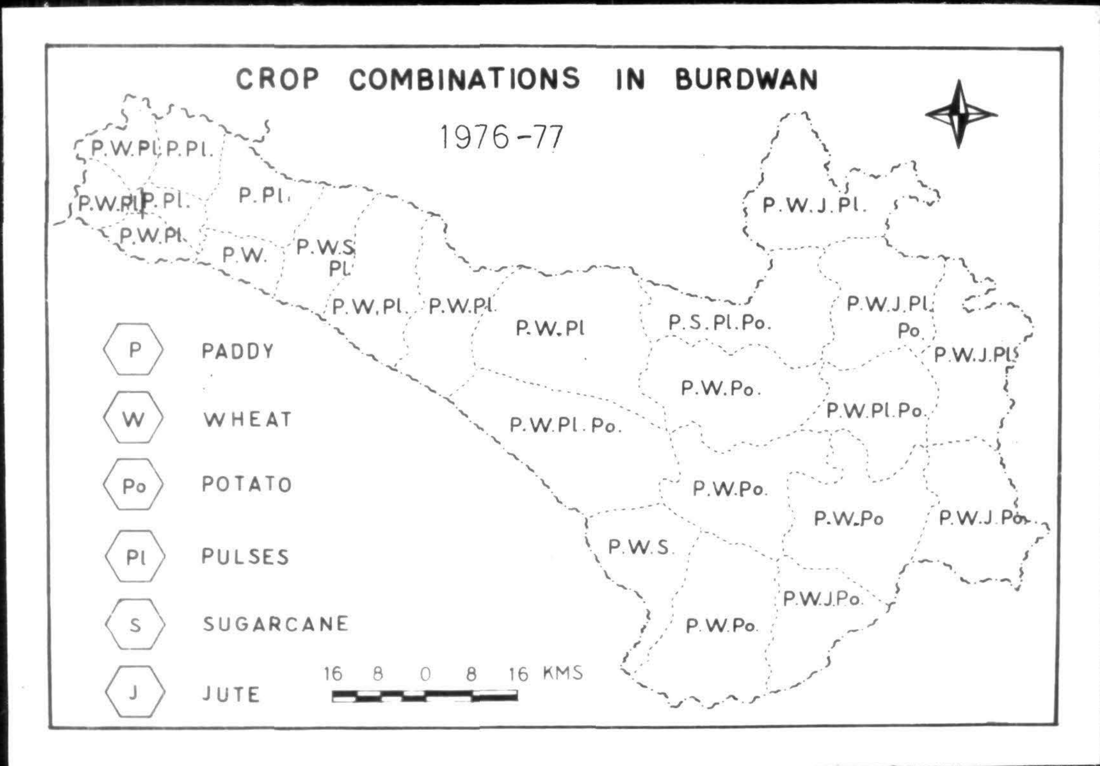
Pulses are grown in almost all the police stations of the district, but there are wide variations in area and yield rate. The acreage and yield rate depend upon several factors, such as, soil conditions, availability of water in the Rabi season and habits and interests of peasants. Pulses are cultivated mainly in the winter season. Gram and pulses are soil replenishing crops and grow well on loamy soil, but in a broader generalisation they can be grown on a wide variety of soils, which are not stiff clayey or very sandy. These are mainly Rabi crops, but a small portion of the pulses is grown as Kharif crops. Medium and comparatively high lands are suitable for the crops. This crop cannot withstand water logging and prefers a little quantity of water. The pulses comprise gram, Masur, Khesari, Maskalai and Moong in the descending order of importance. From the ecological consideration, it is evident that these can be grown widely and

in varied conditions. Jamalpur, Ausgram, Purbasthali, Ketugram, Kalna and Katwa are important pulse growing police stations in the district.

Oilseeds are next to pulses in order of importance in production. The main oilseeds comprise mustard, linseed, til. Other oilseeds viz. castor, groundnut, sesamum etc. cover very small areas. Medium and high lands with good drainage facilities and the loamy and new alluvium are suitable for oilseed cultivation. Linseed prefers heavy soil. Summer til is more important than winter til though both varieties are grown in the district.

The figure 66 shows area under irrigation for different types of crops (Aman, Aus, Boro, Wheat,Potato, Sugarcane, Pulses and Oilseeds) during 1966-67 to 1977-78. In this case the irrigated area 'in hectare' is shown in log value due to long range of data for different crops. The log value of area under irrigation varies from 0.5 to 5.5. Among the different crops, Aman paddy is grown in the better irrigated area and next to it, in order Boro paddy, potato, wheat, Aus paddy. Before 1971-72 Aus and pulses were not cultivated regularly due to scarcity of water. During that period the areas under irrigation available for oilseed, sugarcane, pulses, Aus paddy and wheat were not substantial. Gradually the areas

where such crops are grown are increasing, though, there are fluctuations. The Boro paddy has shown a remarkable change in area under irrigation, which was 2.0 in 1966-67 and 4.5 in 1977-78. The irrigated area for wheat has also changed from 1966-67 to 1977-78. Of all the inputs required in agriculture, water is the most misused and mismanaged commodity not only in Burdwan district but also in all area of our country. Consequently though the water applied per unit of crops produced is low still problem of water logging is existing. The construction of our irrigation projects are defective and they are running at loss. During flood the different irrigation projects release excess water as their capacities are inadequate. As a result, the damage to crops takes place very rapidly by water logging. On the other hand during drought these irrigation projects cannot supply water timely to the growing crop as they do not have sufficient water; moreover a large amount of water is lost through evaporation from the barrage, canal, tank and on the way to the cultivated fields. It is necessary to make fuller utilisation of storage water. Mention has already been made of the loss of water by evaporation from canal, tanks and kuccha nalas and a coroboration of this view can be had in the Anandabazar daily patrika of 28 April, 1981 as translated below : 40-50 per cent of valuable water is wasted from canals, tanks and



CROP COMBINATIONS IN BURDWAN
1976-77
P. W. J. Pl.
P.W.Pl.
P.Pl.
P.W.Pl.
P.Pl.
P.Pl.
P.W.Pl.
P.W.
P.W.S.
Pl.
P.W.Pl.
P.W.Pl.
P.W.Pl
P.S.Pl.Po.
P.W.J.Pl.
Po.
P.W.J.Pl.
P.W.Po.
P.W.Pl.Po.
P.W.Pl.Po.
P.W.Po.
P.W.Po
P.W.J.Po.
P.W.S.
P.W.J.Po.
P.W.Po.
P PADDY
W WHEAT
Po POTATO
Pl PULSES
S SUGARCANE
J JUTE
16 8 0 8 16 KMS


Fig. No. 67

kuccha nalas by evaporation. As harmful weeds grow beside the nala, it is difficult to take water to the higher level lands. It is not profitable to take the water to the distant fields when those closer to the source of water do not need it, as this causes a greater seepage of water in the kuccha nala. Pucca nalas to face the same problem and in addition may get cracked at the end of season. If this wastage of 40-50 per cent of available water be avoided, twice the area of land can be brought under irrigation. "Only about 400 feet long aluminium pipe of 3 inches diameter will be necessary for irrigating uniformly both plain and uneven lands by manually moving it about. It is a proved fact that a 5 horse-power pump set with this 400 ft. pipe can irrigate successfully 11 acre land. Only a shallow tubewell is necessary and the pump set need not work extra hours. As a result the cost of oil and electricity will be almost half for irrigation per acre".[9]

## Present cropping patterns in the district

From the figure of principal crop combination in Burdwan district (Fig. 67 ), it can be seen that paddy is the principal crop which occupies more than 75 per cent of acreage in each police station. The map is drawn on the basis of 1976-77 data. The second principal crop is wheat in almost all the police stations except Barabani, Jamuria, Asansol and some areas on the eastern part where potato occupies the position

of wheat. Paddy-pulse crop combination occurs in Barabani, Jamuria and Asansol, Paddy-wheat in Raniganj. The map shows that there are 2-crop, 3-crop, 4-crop, or 5-crop combinations, denoted in each police station. Those 4-crop or 5-crop are cultivated in different areas of each police station but not more than two or three crops are produced in the same field. Paddy-wheat-pulse crops are usual in Salanpur, Kulti, Hirapur, Faridpur, Kanksa and Ausgram. Paddy-wheat-potato combination occurs in Memari, Burdwan, Raina, Bhatar. Paddy-wheat-sugar-cane-pulse combination is located in Andal; Paddy-wheat-sugarcane in Khandaghosh; Paddy-wheat-pulse-potato combination in Galsi, Monteswar; Paddy-sugarcane-pulse-potato in Mongalkote; Paddy-wheat-jute-pulse combination in Ketugram, Purbasthali; Paddy-wheat-jute-potato combination in Kalna, Jamalpur and Paddy-wheat-jute-pulse-potato combination in Katwa. The crop combination pattern has been adapted to the topography, water supply, soil condition, domestic requirements and demand in the local market. A study of crop-combination regions reflects the variable position of the individual crop within themselves as their integral complex for the analysis and synthesis of the crop land use pattern. For intensive utilization of land it is essential to ascertain and adopt the rotation which is most suitable for land. The crop combination regions are highly dynamic and are

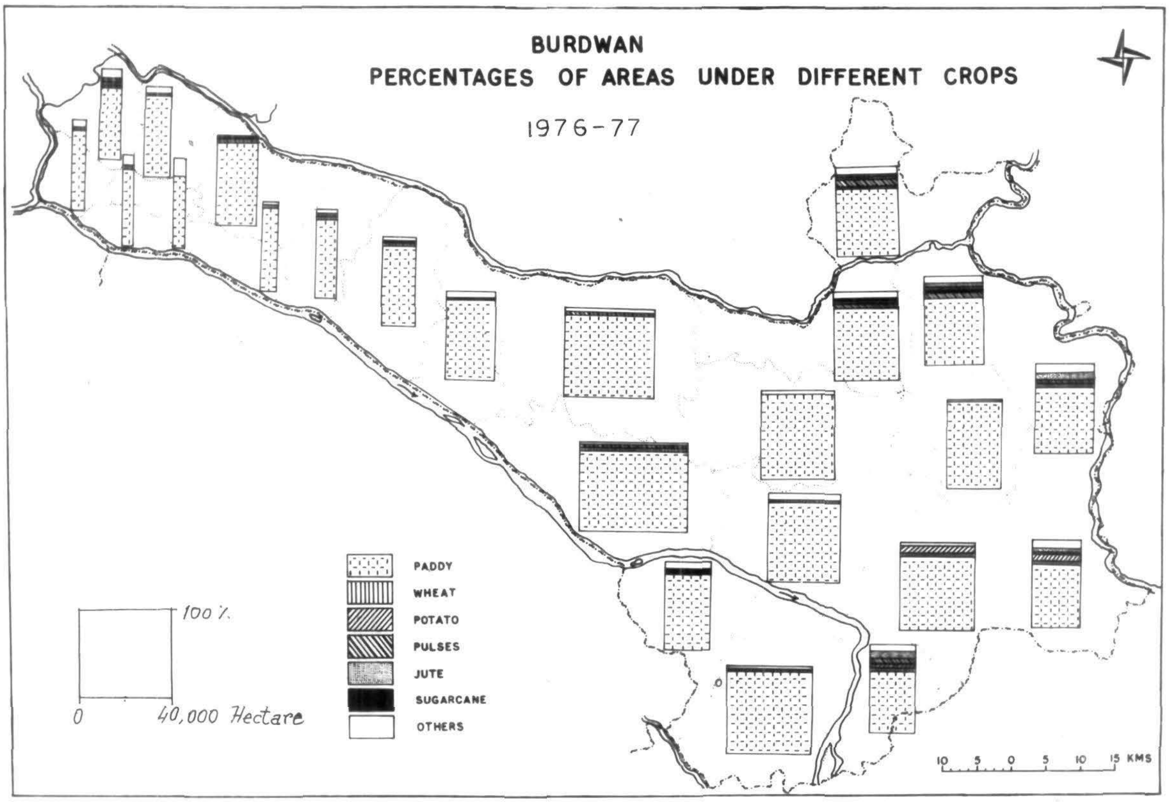

BURDWAN
PERCENTAGES OF AREAS UNDER DIFFERENT CROPS
1976-77
PADDY
WHEAT
POTATO
PULSES
JUTE
SUGARCANE
OTHERS
100 %
0
40,000 Hectare
10 5 0 5 10 15 KMS

Fig. No. 68

subject to constant changes. There must be a transitional zone in between the two crop-combination regions. The aforesaid transitional zone is always dynamic. The dynamic aspect of the regional concentration of agriculture in Burdwan is primarily based on its changing economic activities. The gradual changes of economic activities are brought about with the extension of irrigation facilities, improved techniques of cultivation and improvement in the marketing facilities.

The cropping pattern in the district (Fig. 68 ) is shown by rectangular diagram. Each rectangle represents the net sown area of each police station. The height of the rectangle is divided into 100 for percentage demarcation in all police stations and the base is respectively changed with the area of police station. In this map the acreage of each crop can be comparatively analysed among the police stations. The acreage of other crops is very insignificant while the paddy is the principal crop. The yield per acre is low in the district "not because our soil is incapable of yielding more, but because our agricultural inputs are low, our agricultural practices are not modern, our agricultural management is poor, our farmers lack capital and credit, and want of functional literacy restricts their capacity to understand and apply science and technology to their cultivation".[10]

Rotation of crops usually results in increased yield. Generally in mixed cropping system, there is always one main crop and one or two subsidiary crops. The proportions of the mixtures of different crops depend upon the local soil and climatic conditions. The district demands increased intensity of cropping. The figure 69 shows the Index number of agricultural productivity of different crops. In this case the base crop year is 1956-57 1960-61 = 100. The productivity of all crops (paddy, wheat, pulses, jute, oilseed, potato and sugarcane) varied from 80 to 300 during the period 1960-61 to 1967-68. In between 1967-68 and 1974-75 the productivities of wheat and potato has increased. Continuous cropping with the same crop year after year may be profitable for a few years, but well-planned rotations are likely to be profitable over a long period of time because they conserve and improve the soil instead of depleting the fertility. Best results are usually obtained by combining farmyard manure and commercial fertilizer, which prevents soil depletion more effectively than mere rotation. "A good combination of different crops is often complementary though in other cases the two crops sown together may prove to be competitive both for soil nutrients and other reproducible inputs like capital and labour".[11] P.N.Mathur has explained "the rationale of cropping in terms of labour needs of different crops".[12]

A study of the spatial patterns of crop diversification and specialisation is of vital importance in understanding the contemporary competition amongst crops for area, scope for rotation and effect on productivity. It is considered that keen competition, intensive crop rotation for the maintenance of soil fertility and high profits are associated with mixed cropping systems rather than with crop specialisation, but the choice of cropping system is dependent on physical, economic and social variables.

There are several opinions about the cropping pattern which correlates with different factors. "Abdul Majid found direct influence of the size of holding on the pattern of crops, preponderance of food crops being observed in the case of small farmers".[13]

"M. Meenakshi Malaya observed that there was a significant influence of the extent of urbanization on the cropping pattern".[14]

Z.Y. Jasdanwalla studied that "cropping pattern was influenced positively by distance of the village from the market place and this influence was more significant than that of the size of holdings; borrowings and the value of assets and irrigation".[15]

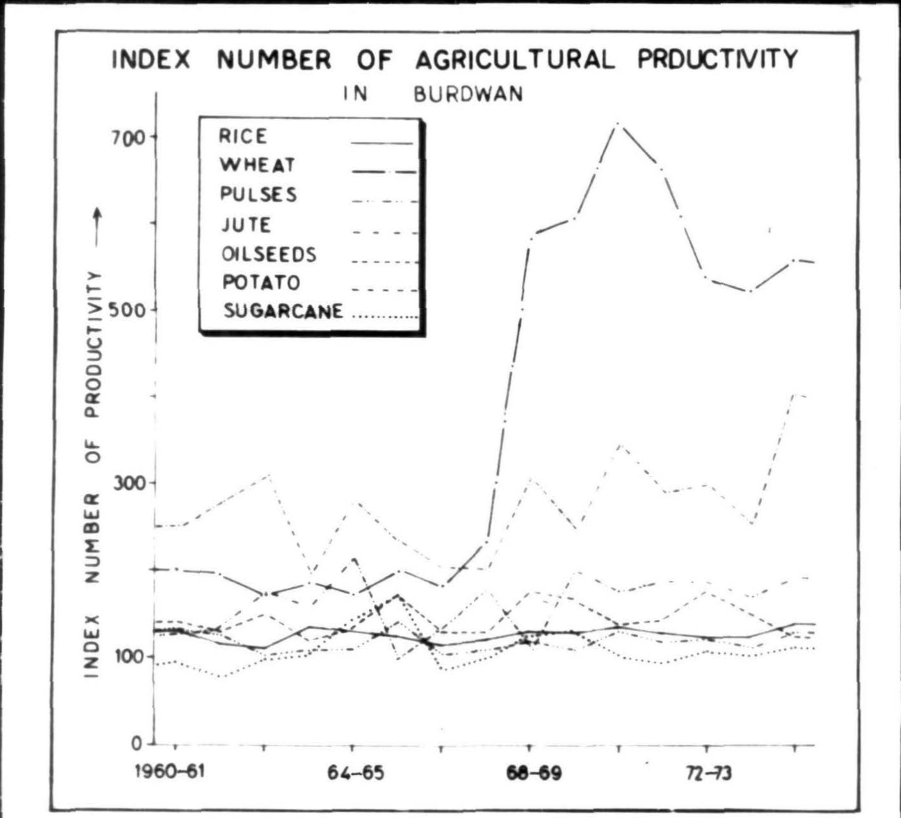

INDEX NUMBER OF AGRICULTURAL PRDUCTIVITY
IN BURDWAN
RICE
WHEAT
PULSES
JUTE
OILSEEDS
POTATO
SUGARCANE
INDEX NUMBER OF PRODUCTIVITY
700
500
300
100
0
1960-61
64-65
68-69
72-73

Fig. No. 69

The cropping pattern is influenced by the size of holding, transport and marketing facilities. A major cause of low agricultural efficiency is due to fragmentation and sub-division of holdings. The fragmentation of land is uneconomic causing wastage of labour, time and also capital. The scattered holdings are not helpful for effective cultivation, proper supervision and full utilization of land. The size of productive land unit is relative and may vary according to the fertility of the soil, method of cultivation, nature of crop and other physico-socio-economic factors. Charan Singh commented "Largely because of diseconomics of management and difficulty in supervision of a large number of hired workers, large holdings attract the use of large machines, thus displacing labour, whereas small holdings limit the use of the machines, thus employing more human labour".[16] If the size of a single land holding is more than what one farmer can effeciently manage, land is not fully utilized because of lack of sufficient labour and if it amounts to less than a critical limit, labour is not fully employed because of lack of sufficient land. Agricultural productivity is related to the size of land holdings and also to the quality and quantity of the inputs. It is thus necessary to analyse the influence of the size of land holding for the study of agricultural pattern at the micro level.

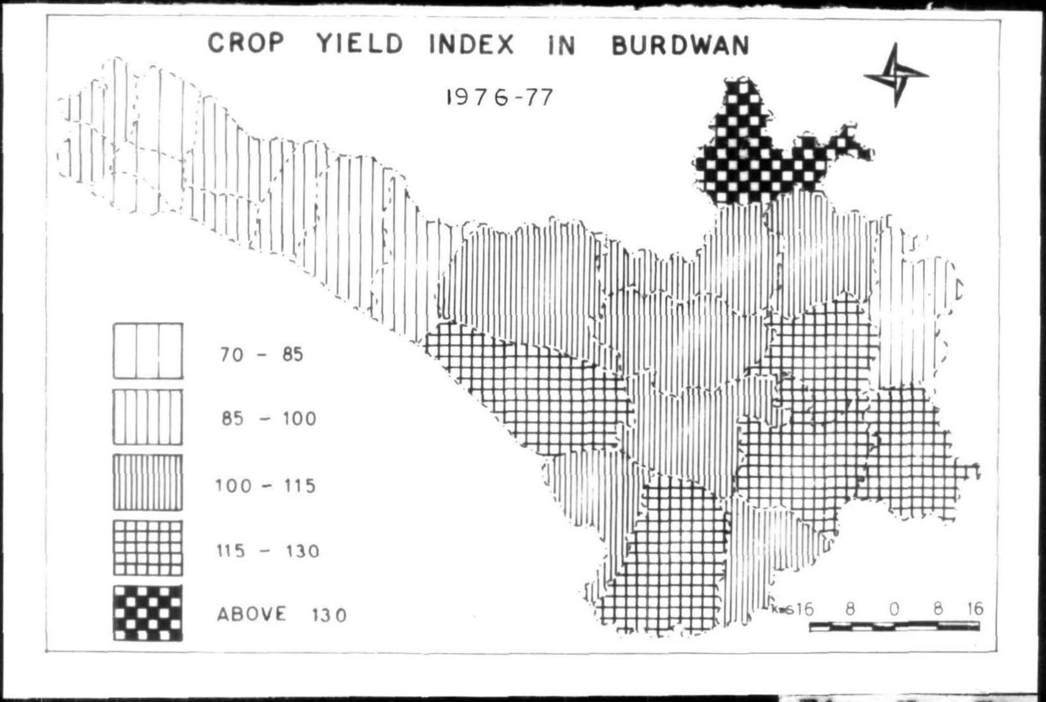

CROP YIELD INDEX IN BURDWAN
1976-77
70 - 85
85 - 100
100 - 115
115 - 130
ABOVE 130
kms 16 8 0 8 16

Fig. No. 70

Agricultural productivity varies from region to region. The determination of variations in agricultural productivity and their probable causes make it possible to demarcate the areas of high and low agricultural productivity. For spatial and temporal comparisons in agricultural productivity, measures to determine the agricultural productivity of each region or for each year have to be developed. The yields per acre in a police station may be high for some crops and low for others, compared to those in other police stations. Also, even in the same region, some crops may be more important than others. Hence, a composite index taking into consideration the yields per acre of different crops and their relative importance in the police station under study has to be developed. The map of "crop yield index"[17] (Fig. 70 ) of the district is one such measure which has shown the determination of agricultural productivity and making spatial and temporal comparisons. The crop yield index is calculated according to the formula :

$$CYI = \frac{\sum\left(\frac{A_1}{B_1} \times 100\right) \times \left(\frac{C_1}{D_1} \times 100\right)}{\sum\left(\frac{A_1}{B_1} \times 100\right)}$$

[Where $A_1$ = Acreage of crop in police stations.

$B_1$ = Total acreage of that crop in district.

$C_1$ = Average yield in P.S.

$D_1$ = Average yield in the District]

These indices indicate how the yield of several crops vary on the average between farms, geographical areas or years. From the figure, it can be explained that the crop yield index varies from 70 to 85 in Hirapur, Asansol, Barabani and from 85 to 100 in Salanpur, Kulti, Jamuria, Ranigunj, Andal, Faridpur, Kanksa, Purbasthali. Highest crop yield index (above 130) is shown in Ketugram, in comparison to other police stations of the eastern part. It varies from 100 to 115 in Katwa, Mongalkote, Ausgram, Bhatar, Burdwan, Khandaghosh, Jamalpur and from 115 to 130 in Kalna, Monteswar, Memari, Raina, Galsi. A general study of the spatial variation in agricultural productivity reveals that the eastern part of the district is agriculturally productive and has higher crop yield indices whereas western part is agriculturally backward and has low crop yield indices. Though the western part does not come under 'arid' zone in the strictest sense of the term, yet the overall characteristics of that part have resemblance to the 'arid' area. Although the average annual rainfall of the area is not as low as the "dry area"[18], there is a little bit of difference in the annual rainfall of the area with that of the district as a whole. The topography of the area is so uneven that rain water cannot be retained and moisture cannot be conserved, which is so very essential to storage water for the growth of the crops. The soil type

of this area is also quite different from the rest of the district, which is partly laterite and partly a red coloured coarse grained sand.

If we consider the following table, it becomes clear that in the smaller-size group of holding (below 5.0) the intensity of cropping is lower than middle-size group(5.01 - 10.0). On the other side intensity of cropping is higher in irrigated zone of small or medium size farm in comparison to unirrigated zone of that size of farm.

Table 3

| Zone | Size group of holding | Intensity of cropping |
|---|---|---|
| Unirrigated - | Below 5.0 | 1.03 |
| | 5.01 - 10.0 | 1.06 |
| | Above 10,0 | 1.06 |
| Irrigated - | Below 5.0 | 1.20 |
| | 5.01 - 10.0 | 1.34 |
| | Above 10.0 | 1.25 |

Source : Indian Journal of Agricultural Economics, 1971, pp. 343 - 349.

The cropping pattern also reveals that crops like wheat, potato, jute, sugarcane etc. cannot be grown in the western part, simply because of scarcity of water. Thus the area may be termed as 'mono cropped area' and many pieces of land lie fallow for the whole year. On personal investigation it has been gathered that the poor farmers do not dare to take the risk of using chemical fertilizers which involve some amount of money and that too in the face of uncertainty of rain water and in the absence of any known sources of water. Recent survey on water inputs seeks to maximise the value of water in crop production. It is necessary to provide facilities to maintain water supplies throughout the non-rainfall season. The improvement of ground water reserves, complete control of it and supplying it timely for use in periods of drought are the most important factors.

The farmer's past experience also tells the same story in which some of the enterprising cultivators even tried to grow high yielding varieties of crop and some others applied fertilisers to the ordinary crops, but which resulted in crop failure due to inadequacy of water, thus adding to their misery. The cultivators in this zone do not like to take the risk of borrowing money because they cannot repay it in time. Moreover, non-availability of agricultural loan in proper time through Government agencies is another factor responsible for the misery

of the cultivators. A major part of the loans taken by the farmers of this zone are used for purchasing seeds etc. while in the irrigated zone i.e. eastern part, these are used for investment purposes such as land purchase, introduction of HYV crops and purchase of improved machinery etc. The labour problem is very acute in the western part. The labourers are more interested in working in a colliery at high wages because they do not want to remain tied to the agricultural land throughout the year.

It can be said that consolidation of scattered plots needs to be accomplished since it will lead to efficient utilization of all the three factors of production, viz., land, labour and capital. "Japan, like India, is a rice growing country, but the Japanese follow a highly developed system of paddy cultivation so evolved as to suit the small farms, which farmers there usually possess".[19] They attach great importance to water management, machanization of cultivation and practice of organic-inorganic balanced fertilization. They use such implements which are easy to handle and to work with in small plots.

Possibilities of alternative cropping and economy that may be derived from it.

The above problems obviously call for some measures for the improvement of the economy on the lines suggested as

follows : Deep tube-well for irrigation purposes may have to be sunk; quick-maturing, high-yielding crops may be introduced. The cultivators may be induced to grow drought resistant varieties of crops, which are suitable for the arid region, such as high yielding bajra and maize. Although these crops are not taken as food by the inhabitants of this area, these crops have high food value and these may be cultivated as well as marketed. The cultivators are of the opinion that if the rivers that flow by the area are utilized by erecting dams across them, sufficient water can be had for growing HYV crops as also some Rabi crops. "In Japan rice is grown on 400-500 mm. water by spreading alkathene sheets in the sub-soil".[20] Therefore, we can definitely reduce these losses by selecting right type of soils with low percolation. With irrigation facilities, multiple cropping can be adopted all over the district but due care has to be taken to see that the crops do not suffer due to rains during harvesting period. Phosphatic and granulated fertilizer units play a very important role. "It has been proved that the application of phosphates at 30-50 kg. of $P_2O_5$ per hectare have increased the productivity of all types of pulses to the tune of 30-40 per cent."[21] A minimum dose of application of 25 kg of $P_2O_5$ per hectare maximises the productivity of some types of oilseeds. It has been recorded that the maximum number and weight of tubers per plot is produced by application of "40 kg of nitrogen per hectare as soil and 40 kg of nitrogen per hectare as foliar spray".[22]

Production improvement can be achieved by increasing land productivity on existing lands or by expanding that total area of arable land and utilising it. Multiple cropping promises large agricultural production as well as greater agricultural employment. An essential requirement of multiple cropping is availability of short duration varieties of crops which are now available. Better results can be had by minimum tillage with judicious use of fertilizers. Crops grown, one after another, should have different rooting patterns so that one crop takes nutrients from the upper layer of the soil while the other taps the lower areas. There should be leguminous crop in the rotation so that biological nitrogen fixation is prompted. By substituting the long duration and less fertilizer-responsive varieties of paddy for comparatively shorter-duration and highly fertilizer-responsive dwarf varieties, the cropping intensity as well as yield per unit area per unit time can be increased many times. Great care has to be exercised in processing land immediately after harvest of paddy with a view to plant second crop. Deep ploughing should be avoided and too much stirring of soil should not be resorted to. High lying and sloppy areas can be planted with trees and grass for making pastures. Pulses may be grown quite commonly after the cultivation of paddy or before the harvesting of it. Land can be profitably utilized for raising a second crop such as pulses and oilseeds. Sesamum and groundnut gives

much higher yield when they are grown in pre-Kharif than during Kharif. The cultivation of some pulses like Moong, Kalai, Soyabean etc., oilseeds like sesamum and groundnut may be adopted during summer in areas where there are even some restricted facilities for irrigation. A suitable oilseed crop has the potentiality of higher yield and adaptability to varied soil and climatic conditions. Sunflower can be grown after the harvest of Aman paddy. The residual moisture that remains in the soil after the harvest of paddy can effectively meet the water requirement of this crop for profitable yield. There is urgent need to increase the production of pulses and oil-seeds in the country.

Growing of cotton (commercial crop) on paddy lands lying fallow may be possible as this crop has an inherent potentiality to draw moisture from a deeper zone with the help of its longer tap roots. A good yield can be obtained under mixed broadcast of wheat (HYV) and mustard in 1 : 1 alternate row of plantation. Maize and wheat can be sown in between rows of paddy about two weeks before the paddy is harvested. Water should be taken off the paddy land as soon as the soil surface is dry enough. Mixed cropping with legumes will be more economical and mutually beneficial for the improvement of soil and crop. There is an almost infinite number of different cropping pattern sequences and rotations in utilising the high yielding varieties. Paddy-Jowar-Bajra-Maize-Jute can be grown in the

Kharif season, wheat-potato in the Rabi season, and vegetables-pulses-oilseeds in between Kharif and Rabi season. Bajra crop is grown in areas of low rainfall. Introduction of hybrid bajra has opened up many new possibilities. It scores over other cereals mainly due to its superior performance under moisture stress and low soil fertility, its short growing season, its capacity to withstand unpredictable fluctuations in temperature, moisture and to respond to great improvement in cultural practices. It needs to be planted by the end of July. Among the methods of sowing, one row of bajra and two rows of legume give the highest return.

Conclusion : In the vast plain land of the eastern part, double cropping practices are followed but many pieces of land remain fallow due to scarcity of water. In the western part the lands are cultivated only for monocrop. Due to undulated topography in that part many fallow lands remain uncultivated throughout the year. The monocropped land remains fallow about half of the year for scarcity of water. Such wastage of land, labour and crop should not be allowed in our poor country. Many types of crops, such as Jowar, Bajra, Ragi, pulses, oilseeds, vegetables, etc. food crops can be cultivated in the fallow land because they require a little quantity of water. Among the nonfood grains, various types of grasses, forage crops and trees can be planted as commercial or cash crop. It is also

possible in many areas to put larger areas under double cropping even as rain-fed crops because there is normally some precipitation even during the non-monsoon months sufficient for crops like - gram, mustard, bajra etc. The fallow land can be transformed into pasture land or forest by means of afforestation. It can be said, therefore, that maximum utilisation of land should be made from which the district will get sufficient return. This can be accomplished, not by the farmers alone but with the help of Government agricultural offices. In some cases it may not be possible for a farmer to grow those crops which will maximise his return because he does not have the requisite capital to invest nor the know-how that may be necessary for changing the crops. Another reason - probably a more important one - is that the farmer is guided by tradition in the selection of crops that he presently grows. Therefore, "it is necessary to introduce suitable legislation empowering the Government to enforce the type of cropping pattern best adjudged by them for the different regions".[23]

The need for good land-use planning and adoption of suitable cropping pattern is more urgent today than at any time in the history of this country. This is essential for ensuring the most rational use of land and increasing the productivity, per unit time. Cropping patterns followed in the country are based on the traditional system of subsistance farming where

every farmer is trying to produce every thing he needs. It is in fact based on the utilisation of the inherent fertility of the soil without use of much of the modern inputs, such as fertilizers, pesticides and other ingredients of science based technology. The introduction of high yielding and fertilizer-responsive varieties capable of giving substantially greater yield per unit area per unit time as compared to the traditional tall varieties; coupled with the present day development of fertiliser industry, development of transport and means of communication, and of marketing system, the emerging concept of production for the market instead of home consumption, all these make it necessary to plan most efficient cropping patterns. "Multiple cropping demands efficient planning and good cultural techniques, an assured and well controlled water supply, relatively heavy applications of fertilizer and agrochemicals, and a more sustained evenly spread work load".[24] Such a plan will make possible the most efficient utilisation of land, water and man power in agriculture in addition to the benefit derived from the natural advantages of abundance of sunshine and a variety of climate and crops with which this district is endowed.

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# CHAPTER - VII

# IMPACT OF GREEN REVOLUTIONS ON AGRICULTURE IN THE DISTRICT OF BURDWAN

## Meaning and scope of Green Revolution

From the standpoint of overall economy of our country the fast growing population presents a formidable challenge and a problem. The population explosion and the ever increasing demand for more food and other basic needs of man are pressing the use of land to its limits. The policy makers decided to solve the economic as well as food problem of such a densely populated country. For a long time, agriculture has played an important role in the development of our overall economy. In the field of such food problem, a revolution in agricultural development was brewing slowly. The essence of this new revolution was a dramatic and forcible change in the Indian agrarian structure. It implied a thorough change in agricultural economy. In short, 'Green Revolution' wanted to bring about a large increase in agricultural production in a short space and time by means of high yielding varieties of seeds and new methods of cultivation. "It means breeding plants that will bear more edible grain - the 'two ears where only one grew before' - and thus increase yields without increasing cultivated crop areas".[1] The core of the new technology consisted of new-researched seeds with optimum

inputs, i.e., irrigation, fertilizer, and pesticides under new agricultural practices. Without optimum irrigation, fertiliser pesticide and scientific technique, the new seeds, however, produce highly variable output. Though at the beginning of the Revolution the planners thought that these new varieties would give bumper crop production all along.

The basic goal of this new strategy is to maximise agricultural production utilizing irrigation measures, proper water management practices; increased use of fertilizers; adjusting in the time of sowing, planting, harvesting; proper application of pesticides and selection of proper crop rotations. The new strategy as Intensive Agricultural District Programme (IADP) was chalked out in 1959 and put into action during 1960-61. The agricultural policy included the rapid increase of agricultural production through a concentration of administrative, financial, technical and natural resources.

The main objectives of the package programme was extension of multiple-cropping areas and introduction of cultivation in dry areas using high-yielding varieties of seeds combined with timely irrigation, optimum doses of fertilizers and pest control measures.

"Generalising about the experiences of the new technology in under-developed countries, Earnest Feder correctly said that 'the Green Revolution' is a programme for large land owners par excellence and cannot be different; they are already better equipped, have almost exclusive access to input and output markets and are the major, if not the almost exclusive, recipients of agricultural credit".[2] The extensiveness of the green revolution in our poor country is not very remarkable, both in terms of acreage and output. The future scope also is very limited. The district of Burdwan was selected as an IADP area during 1960-61 as the district is known as "granary of West Bengal". The district had been selected as an IADP area due to the favourable conditions of topography, soil and climate and additionally the agricultural production of the district was already much better than that of other districts. Impact of Green Revolution on this District needs a careful study.

<u>How it started</u> :

Green Revolution in wheat was first introduced in Mexico by four American plant geneticists financed by the Rockfeller Foundation. Due to excessive production Mexico began to export the surplus crops. Withthis success, "the Rockfeller Foundation teamed up with Ford to repeat the performance in Asia - this time with rice - and founded the

International Rice Research Institute (IRRI) in the Philippines in 1962."[3] The Green Revolution was gradually extended to all major food and fodder crops in the tropics. The problem also was very acute in our country, because of the high rate ~~of~~ of increase of population. The agricultural revolution found its way a few years later into India, where it had been found more essential to increase the rate of productivity to solve the food problem. In India, the modernisation of agriculture was started first in Punjab after Independence. The refugees from Pakistan consolidated the small land holdings into large ones and began to cultivate by new technique. During the fifties West Bengal had not started such revolution due to some disadvantages, i.e. undulated topography, small land holdings, uncertainty of water availability. But acute food problem rendered it necessary to start the Green Revolution in West Bengal. As Burdwan is the richest food producer in West Bengal, where all the conditions of Green Revolution were in existence the planner decided to initiate the Green Revolution in Burdwan district. The farmers in the Punjab being more active and energetic than those in the remaining parts of India it is they who introduced the scientific technology in crop production. The work of consolidation of holdings in the Punjab was already started during the British period in 1920 through co-operative consolidation societies. Originally the progress of the work was very slow but after

Independence the progress was rapid. Next to ~~the~~ Punjab the agricultural revolution swept over Haryana and Ganga-Yamuna-Doab. In the agricultural revolution in the Punjab and Haryana, the foremost place was given to wheat production. The new agricultural strategy in paddy production came in some parts of south and eastern India a decade later. The Green Revolution has succeeded a little in case of wheat production but not so much in paddy.

Green Revolution in Burdwan

It has been observed earlier that in West Bengal, Burdwan was selected as a place to grow more food under the Intensive Package Programme. Naturally, this selection was the result of several factors. Without doubt, it may be said that with a vast area of fertile land, Burdwan has been the main source of the food supply for the state from very early days. So importance was given to grow more production in Burdwan in terms of agriculture and hence several modern techniques and other necessary arrangements have been adopted.

Seeds : The basic input is the high yielding variety of seeds. Among high-yielding varieties of paddy seeds, Jaya, Ratna, Pankaj, IR-8, IR-20, Vijoya etc. are now cultivated in Burdwan. Of the HYV wheat seeds, Kalyansona, Sonalika, Safed lerma, Chotilerma, Sarbatisonora were cultivated in

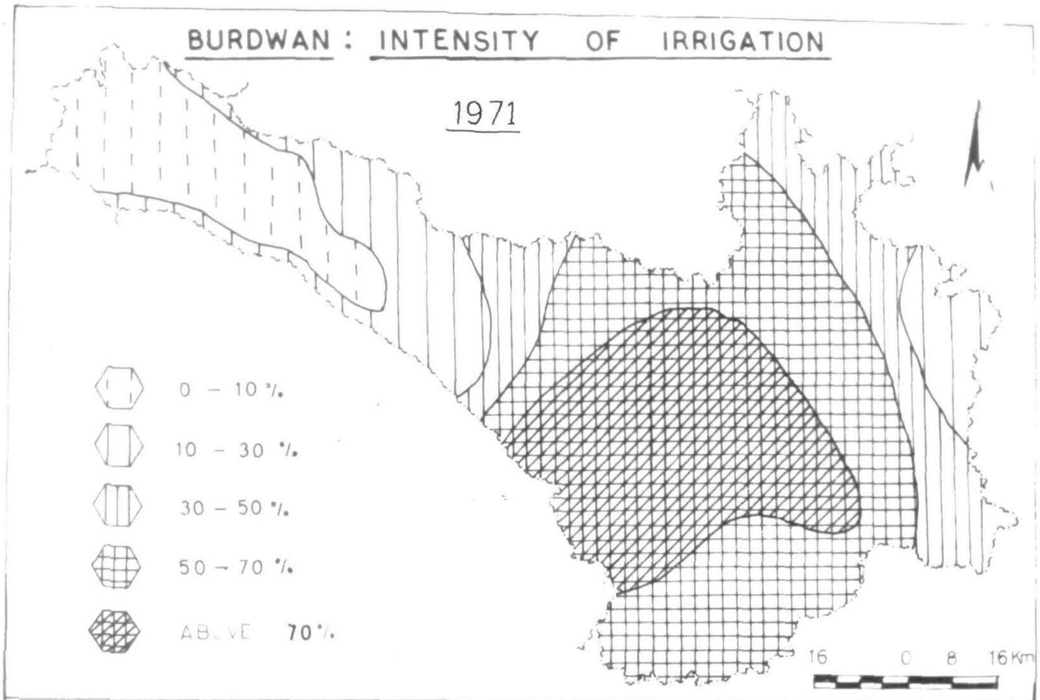
Pump irrigation for cultivation in Andal P.S.

A branch of Canal without any water in Kanksa area due to scarcity of water supply during winter.

Donga irrigation from Damodar canal in Galsi

the district during seventies, but at present the coverage of it has been reduced due to low output and poor demand. Several high yielding varieties of potato have been evolved and are now cultivated a little in the district. Among them Kufri-sindoori, Chandramukhi etc. are important. Each high-yielding varieties of seed bring in a new set of cultural practices. The farmers mostly use the seeds left over from the previous harvest. The owner cultivators are in a position to apply more HYV seeds than the poor tenants.

Irrigation : The water management system has assumed a place of importance among the inputs. These HYV seeds need water at specific periods of sowing and growing and require regulated application of water with good drainage facilities at the same time. The timing of irrigation is of the essence for optimum yield. Unfortunately, the timing for irrigation is a vexed problem in this district because of vagaries of weather. Regulated water supply is intended for paddy production. The object of irrigation is to ensure the supply of water as and when required for agricultural purposes for protecting and augmenting yield with the help of rich silt loamy water supplies from the river. In the district main sources of water supply for agricultural purposes are rainfall, well, tank and canal irrigation.


BURDWAN : INTENSITY OF IRRIGATION
1971
0 – 10 %
10 – 30 %
30 – 50 %
50 – 70 %
ABOVE 70 %
16 0 8 16 Km

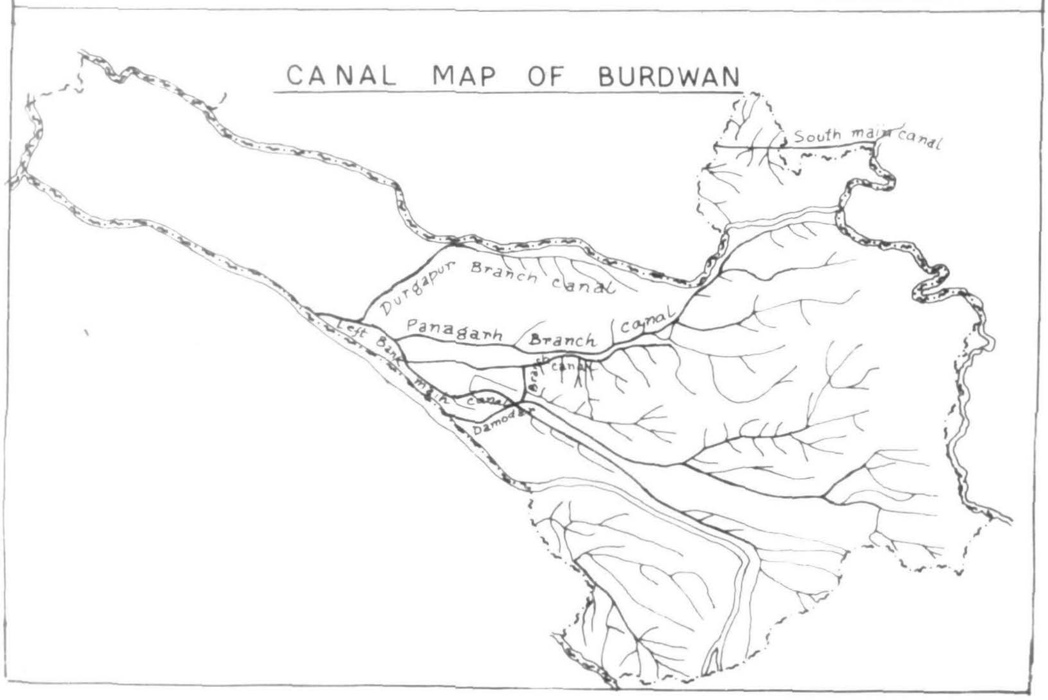
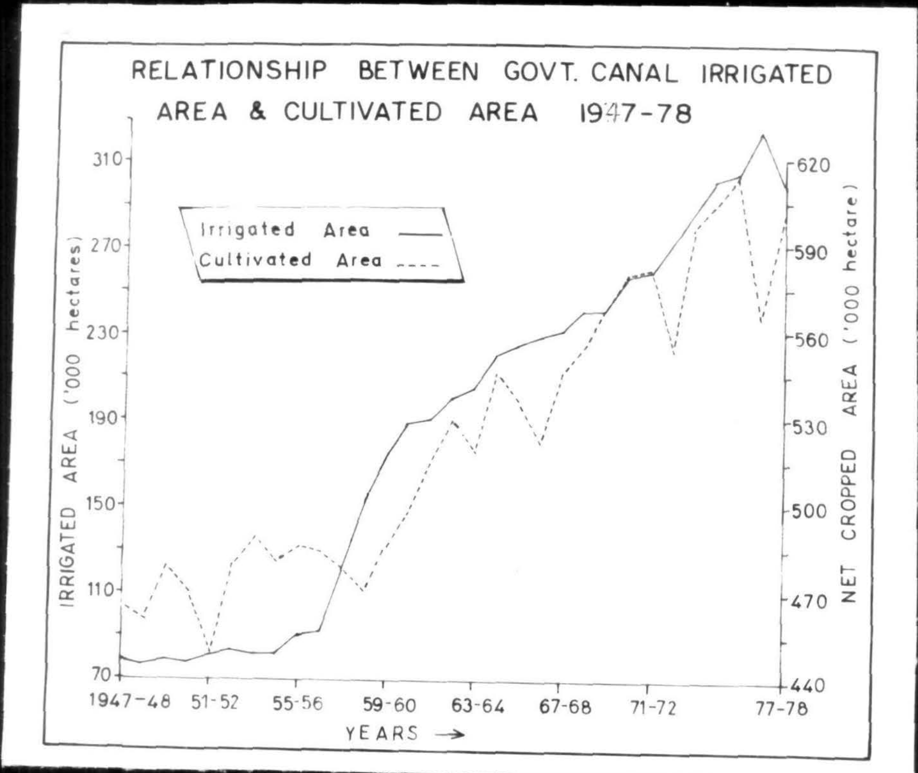

CANAL MAP OF BURDWAN
South main canal
Durgapur Branch canal
Panagarh Branch canal
Left Bank main canal
Damodar

Fig. No. 71

The figure shows (Fig. 71 ) the distribution of canal in the district. The map shows the eastern part as canal irrigated area and western part as completely devoid of facilities of canal irrigation. In the eastern part even some of the police stations get more opportunities of better irrigation from canal. There is no facility of canal irrigation in Purbasthali. These canals, again, are fully dependent upon the strength of the monsoon. The Damorar Valley Corporation supplies irrigation water to about 202,500 hectares, and the small Mor Project to an additional 12150 hectares. The acreage increases in the central and eastern part of the district due to facilities of canal irrigation. The eastern part is a vast plain land with natural irrigational facilities but undulated western part does not have such facilities. It is a surprising fact that modernisation methods i.e. canal irrigation have been applied more in the bountiful east rather than in the barren west. There is also lack of ground water facilities. All these canals do not have a net work of field channels for leading irrigation water to the farmers' fields. Where the cultivated areas have facilities of irrigation the cultivators tend to adopt improved farm practices.

The Figure shows (Fig. 71 ) the highest intensity of irrigation present in the police stations Galsi, Memari,



RELATIONSHIP BETWEEN GOVT. CANAL IRRIGATED AREA & CULTIVATED AREA 1947-78
Irrigated Area
Cultivated Area
IRRIGATED AREA ('000 hectares)
NET CROPPED AREA ('000 hectare)
310
270
230
190
150
110
70
620
590
560
530
500
470
440
1947-48
51-52
55-56
59-60
63-64
67-68
71-72
77-78
YEARS →

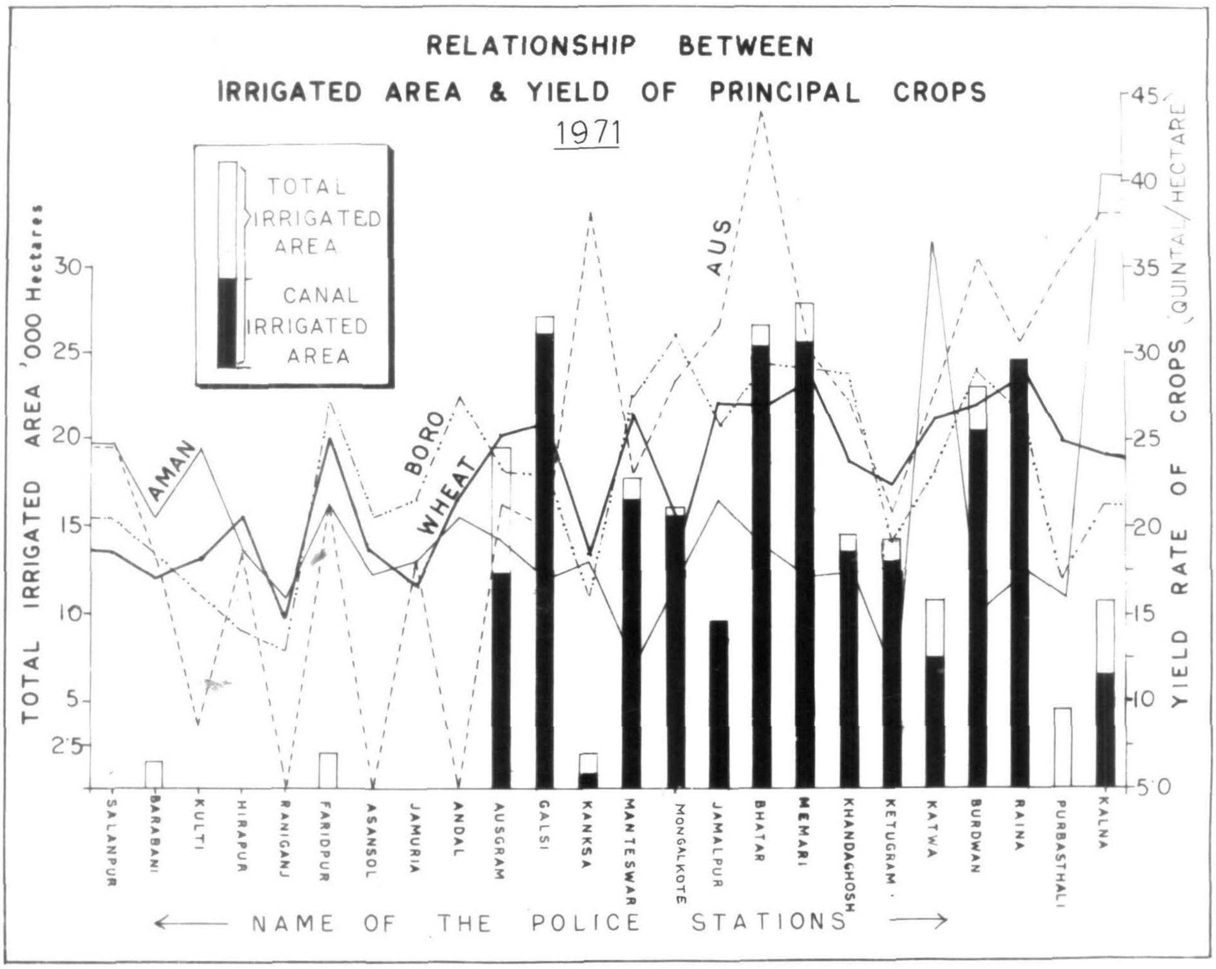

Fig. No. 72

Khandaghosh, Burdwan, Bhatar (abowe 70 per cent). 50-70 per cent intensity of irrigation is occupied by Ausgram, Jamalpur, Raina, Mongalkote, Ketugram, Monteswar and 30-50 per cent by Katwa, Kalna. The intensity of irrigation is very low all over other police stations of the district. "Intensity of Irrigation",[4] is expressed by following the formula :

$$\frac{I}{S} \text{ X } 100 \quad \left[ \frac{\text{Net irrigated area X 100}}{\text{Net sown area}} \right]$$

If correlation between intensity of irrigation and cultivated area and production of crop can be effected the result must be positive. That means where the intensity of irrigation is high, the production also is high. Therefore, "the need for a well co-ordinated inter-disciplinary water management system has assumed a greater importance with the introduction of new high-yielding varieties".[5] Then there is the problem - that of a large amount of water being wasted because of lack of a proper water management system. Water logging and flood are also other problems of irrigation.

It may be explained from the figure of 'relationship between irrigated area and cultivated area' (Fig. 72) that both are fluctuating simultaneously. The irrigated area was very small during the period 1947-48 to 1959-60, after that


RELATIONSHIP BETWEEN
IRRIGATED AREA & YIELD OF PRINCIPAL CROPS
1971
TOTAL IRRIGATED AREA
CANAL IRRIGATED AREA
TOTAL IRRIGATED AREA '000 Hectares
YIELD RATE OF CROPS (QUINTAL/HECTARE)
AMAN
BORO
WHEAT
AUS
30
25
20
15
10
5
2.5
45
40
35
30
25
20
15
10
5.0
SALANPUR
BARABANI
KULTI
HIRAPUR
RANIGANJ
FARIDPUR
ASANSOL
JAMURIA
ANDAL
AUSGRAM
GALSI
KANKSA
MANTESWAR
MONGALKOTE
JAMALPUR
BHATAR
MEMARI
KHANDAGHOSH
KETUGRAM
KATWA
BURDWAN
RAINA
PURBASTHALI
KALNA
NAME OF THE POLICE STATIONS
Fig. No. 73

the irrigated area served by Government canal has been increased gradually. In comparison to that the cultivated area has been increased with considerable fluctuations. Hereby, the relationship expresses that there are several other factors on which depend the cultivated area of the district. Some parts of the district are quite unsuitable for canal irrigation due to undulating land surface.

The Figure shows (Fig. 73 ) the relationship between irrigated area with yield of principal crops. The crops of several police stations, e.g. Salanpur, Kulti, Hirapur, Ranigunj, Faridpur, Asansol, Jamuria and Andal are fully dependent upon monsoon. In Barabani, Faridpur and Purbasthali, the crops are cultivated partly by well and tank irrigation and partly by monsoon. In other police stations of the district, i.e. most of the eastern part, the crops are cultivated partly by canal irrigation. That is why, Boro paddy (Ratna, Jaya, Pankaj etc.) cultivation takes place over that part only. Aus and Aman paddy are cultivated by monsoon rain throughout the district. A little quantity of wheat is cultivated in the district by tank and well irrigation. The yield of Aus, Aman, Boro paddy and wheat also vary with the irrigated area. Every where there are fluctuations in yield of crops. The yield of crops is more or less high over those areas, where the crops are cultivated by timely canal irrigation.

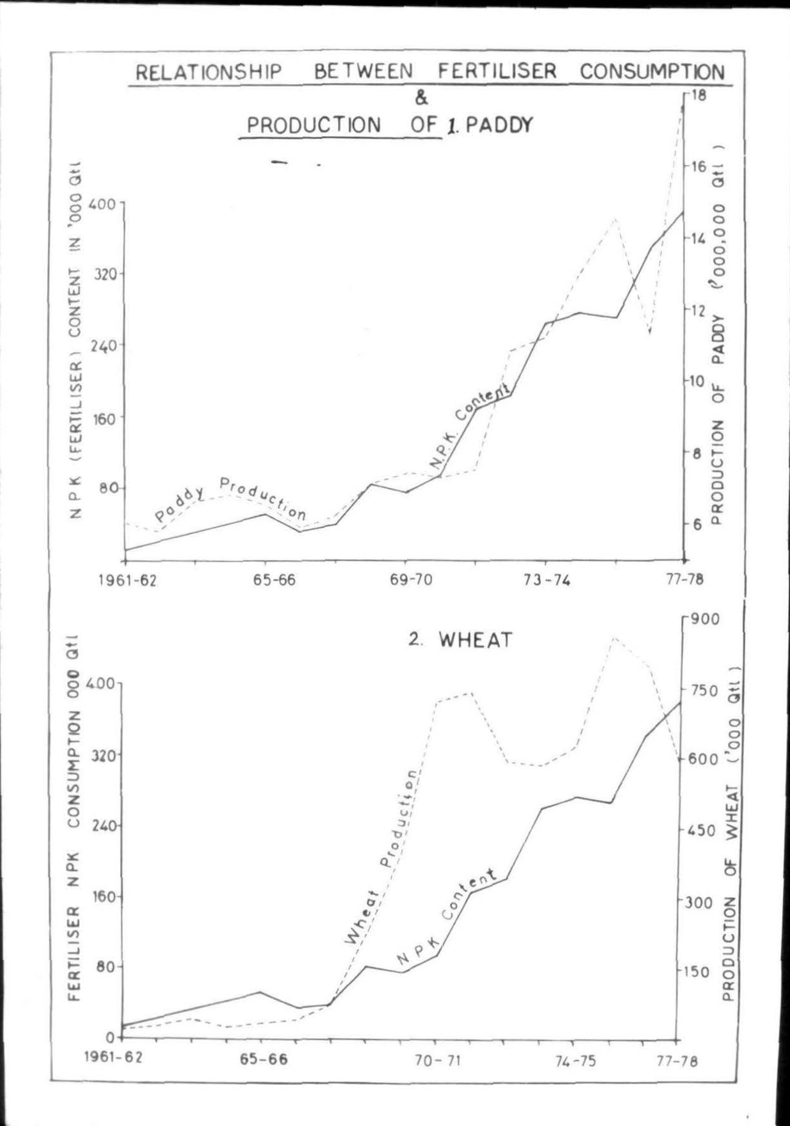



Fig. No. 74

Application of fertiliser in the paddy field near Memari P.S.

The sprinkle-irrigation appears profitable in maintaining the soil moisture for increasing per unit production.

Fertiliser : One of the most important features of modern farm practices is the regular application of manures and fertilisers, according to the needs of the soil, topography of the land and the requirement of the plants. Some of the soils are deficient in nitrogen or phosphorus or potash or organic matter. Some areas are deficient in one or more of the major and minor nutrients. Chemical fertiliser is an effective input for quick increase in crop production. The amount and timing of fertiliser application is also relevant to the crop requirement. Foliar spray of fertilisers to the soil is very much beneficial. There is a wastage of fertiliser if the rain comes just after the application of fertiliser to the field, for the nutrient is washed out with water. For this difficulty the farmers cannot use the fertiliser just in time. Another problem faced by the poor farmers is the non-availability of the imported fertiliser. The figures of the relation between fertiliser consumption and production of paddy and wheat (Fig. 74 ) show that the consumption of fertiliser was low during the period 1961-62 to 1968-69. Before that period the actual data is not available. After several years of the introduction of modernization method the amount of fertiliser application has been

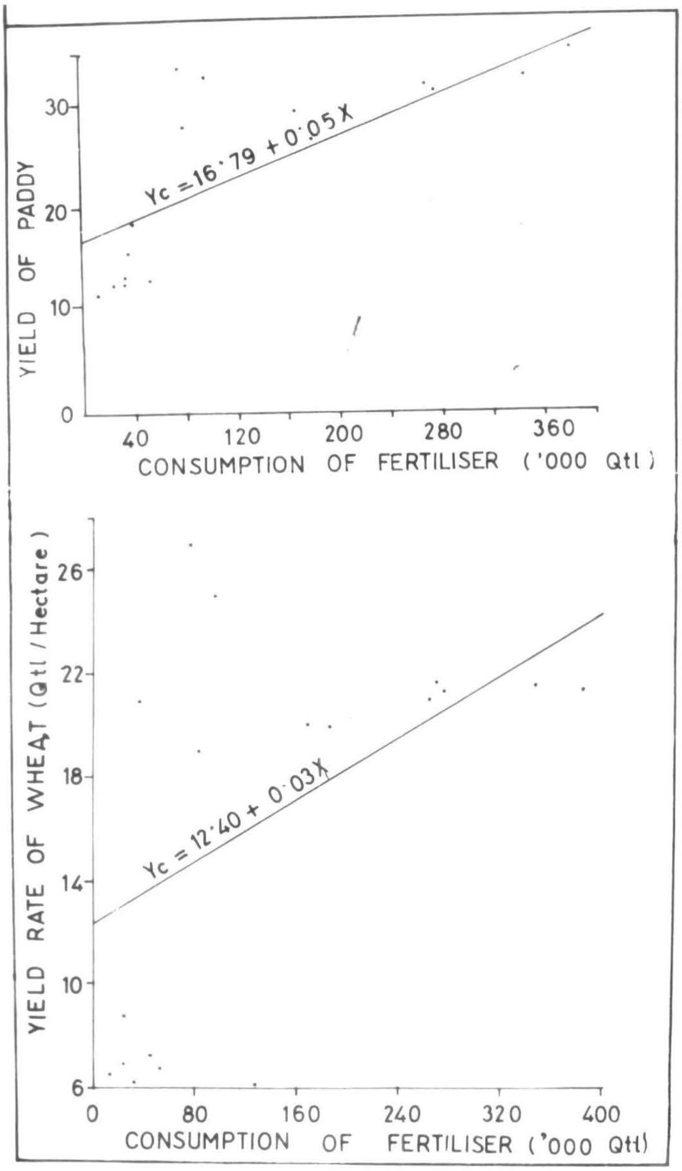

Yc = 16·79 + 0·05 X
YIELD OF PADDY
0
10
20
30
40
120
200
280
360
CONSUMPTION OF FERTILISER ('000 Qtl)
Yc = 12·40 + 0·03X
YIELD RATE OF WHEAT (Qtl / Hectare)
6
10
14
18
22
26
0
80
160
240
320
400
CONSUMPTION OF FERTILISER ('000 Qtl)

Fig. No. 75

increased. With the increasing application of this input the production of paddy and wheat has increased to about double the quantity. It can be expected that the production might increase much more than this. The production of paddy has been found to increase simultaneously with fertiliser application except in the year 1976-77 due to inadequate rainfall. In case of wheat, the production increased upto 1971-72, but after that the production trend did not keep up with fertiliser consumption. The following figures show the correlation between consumption of fertiliser and yield of paddy (Fig. 75 ) and yield of wheat (Fig. 75 ). Both the figures show medium-high degree positive correlation co-efficient. The correlation co-efficient of paddy is 0.76 and wheat is 0.82. The regression equation of paddy is $Yc = 16.79 + 0.05X$. and wheat is $Yc = 12.40 + 0.03X$. Therefore, it can be interpreted from the above illustration that it is a dependable and essential input for increasing the production of crops. Without assured irrigation, chemical fertilisers cannot be used with confidence by the farmers because irrigation is an essential requirement for fertiliser. The name of the fertilisers applied by farmers are Sufala, Urea, Ammonium sulphate, Growmore, Potash etc.

<u>Pesticides</u> : Besides fertilisers, the use of pesticides is equally important for high yielding variety seeds. The

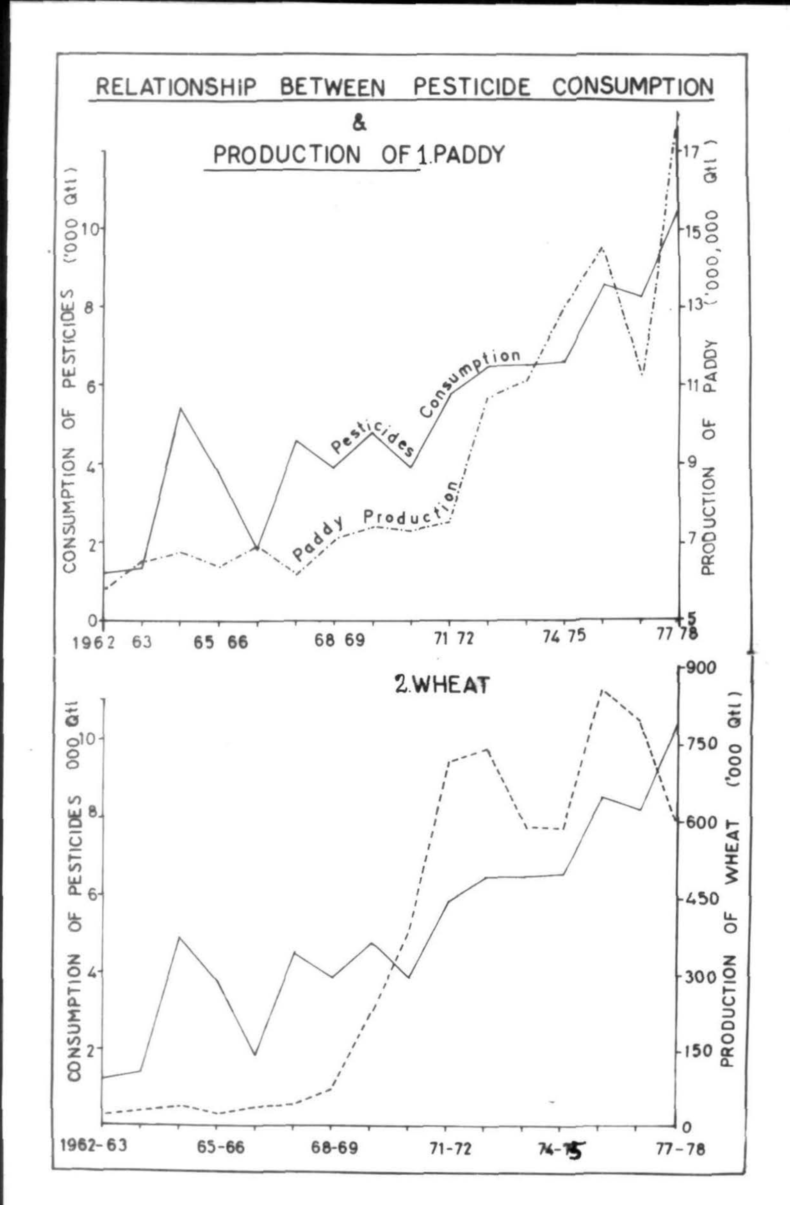
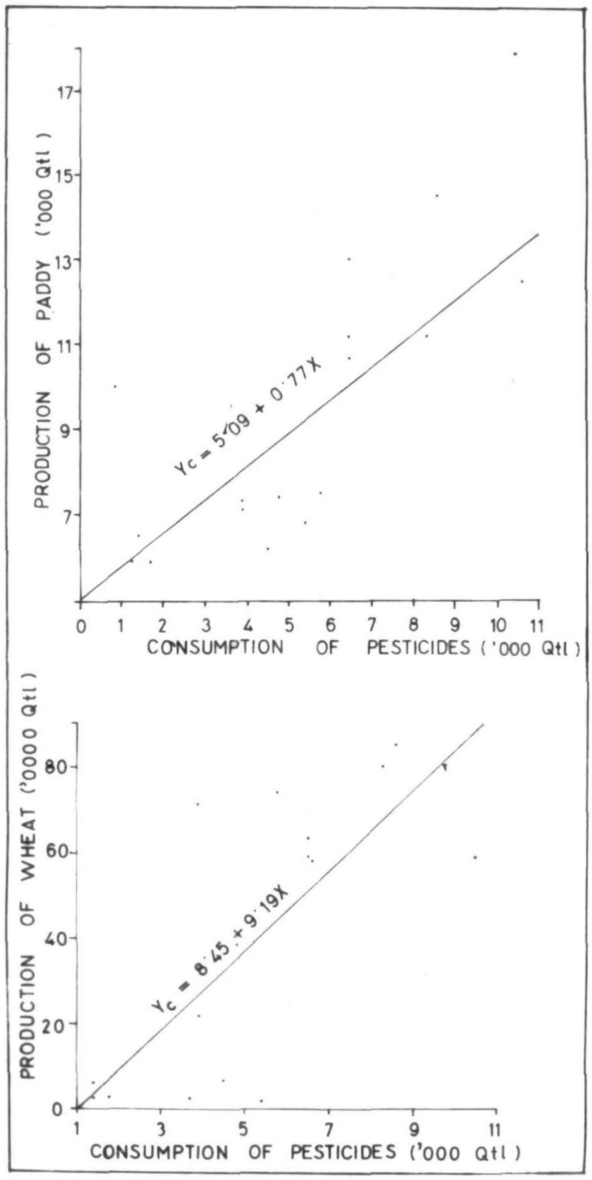



Fig. No. 76

Application of pesticide in the field of Boro paddy near Memari P.S.

HYV-seeds are highly susceptible to various pests and diseases at the late stage of the growth of the plants. Monsoon is accompanied with humidity and lack of sunshine, which in turn leads to a much higher incidence of plant diseases. Quite a large quantity of food grains is lost through attacks of insects and diseases. In the early period the use of pesticide was negligible, a few farmers only applying it, as it was an imported and a highly priced input. In 1962, a factory was established at Calcutta for the production of pesticides. But even today our country is not at all self-sufficient in pesticides and to a great extent it has to depend on the imported pesticides. Besides, they are costly inputs. The application of appropriate pesticides at optimum time is also another important task of the farmers. The relationship between consumption of pesticides and production of paddy and wheat has been shown in the Figure. (Fig. 76 ). The production of paddy increases with much consistency on increasing consumption of pesticides. In other words, the production of wheat increases with the increased consumption of pesticides but there is no causal relationship between the two variables. In 1964-65 and 1965-66 the consumption of pesticides was more but the production of paddy and wheat was relatively low during that time. Therefore, the analysis of the figure says that pesticide is more related to production of paddy than to wheat. The



PRODUCTION OF PADDY ('000 Qtl)
$Y_c = 5.09 + 0.77X$
CONSUMPTION OF PESTICIDES ('000 Qtl)
PRODUCTION OF WHEAT ('0000 Qtl)
$Y_c = 8.45 + 9.19X$
CONSUMPTION OF PESTICIDES ('000 Qtl)


Fig. No. 77

correlation co-efficients of consumption of pesticides with paddy is 0.9 (Fig. 77 ) and wheat is 0.73 (Fig. 77 ). In case of paddy it shows positive high degree correlation and increase of wheat it is positive medium-high degree correlation. The regression equation of paddy is Yc = 5.09 + 0.77X and wheat is Yc = 8.45 + 9.19X. It is also an essential requirement for HYV paddy and wheat. The non-application of this in proper time causes damages of crops and reduce the productivity. The names of the pesticides which are used by the farmers in the district are Endrin, BHX, Folidol etc.

In addition to pests and insects, weed control also poses a serious problem. A large amount of fertiliser application to soil, encourages the growth of weeds. Therefore, weeding must need to be done regularly for greater production from the new HYV seeds with much amount of fertiliser consumption. In a cycle of paddy and wheat production of any time, weed control should be necessary for three times or more in a harvesting season.

**Mechanization of implements:**

"Parthasarathy and Abraham, supports the view that tractor technology is less expensive, despite its capital intensive nature, from the point of view of large farmers".[6] It is easy and profitable to use tractors in vast plain land

but in the district like Burdwan where the lands are fragmented into very small units, it is not suitable at all. Moreover, the topography in the district is undulated, particularly in the western part. Tractors also are not suitable to all soil conditions. Another factor is the employment problem for it is excessively labour and time saving mechanised input. For that reason large scale tractor application is not yet made in the district. The only implement adopted in the district is the paddy thresher which has become very popular at present.

Table 1

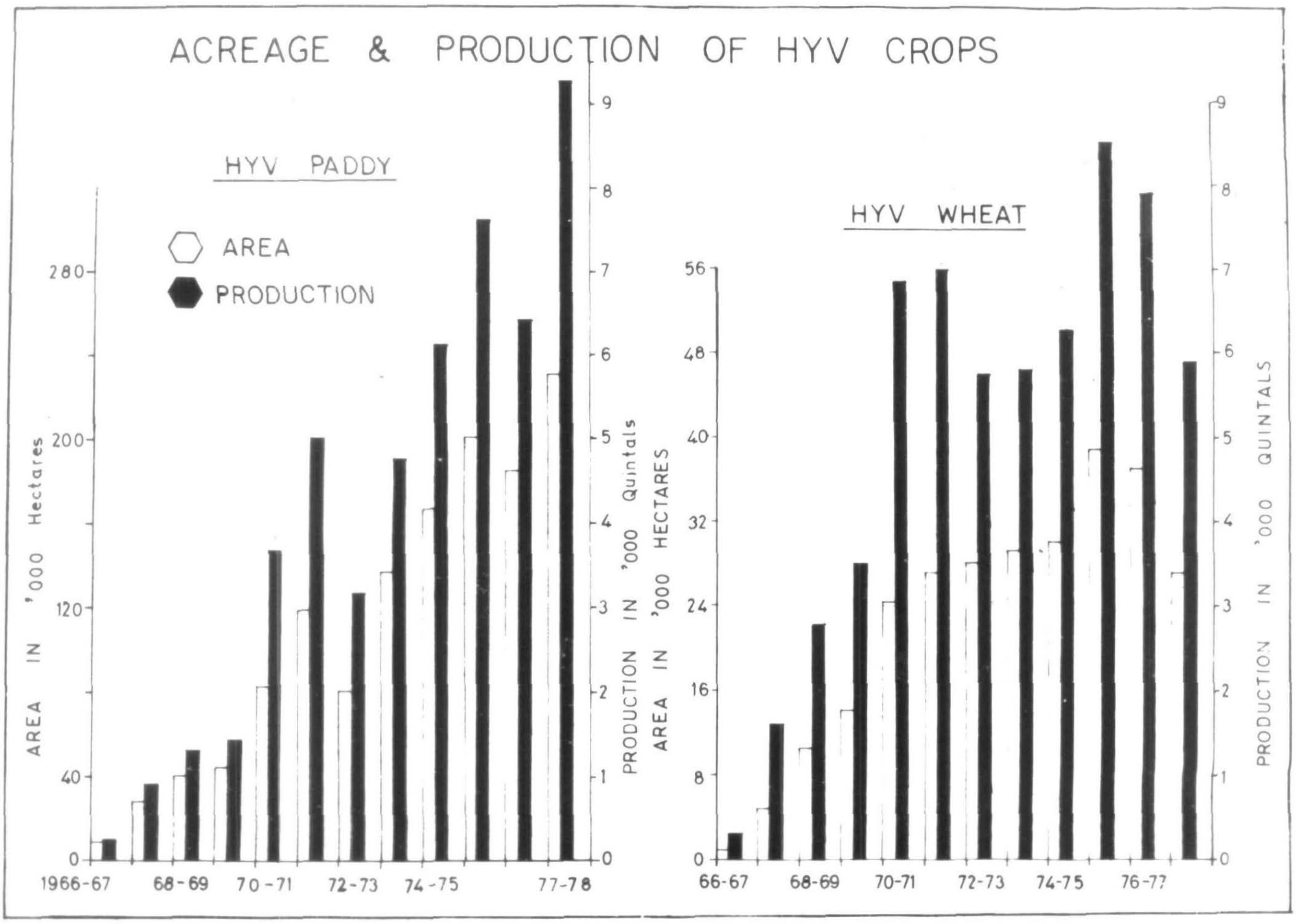
Agricultural Machineries (In Number)

| Year | Tractors | Wooden Plough | Iron Plough | Carts | Crushers | Diesel pumps | Other Pumps | Persian Wheel |
|---|---|---|---|---|---|---|---|---|
| 1950 | 13 | 201091 | 461 | 89651 | 1721 | 40 | 42 | 13 |
| 1956 | 27 | 238838 | 226 | 118555 | 814 | 114 | 3 | 6 |
| 1961 | 25 | 177723 | 251 | 91909 | 731 | 75 | 50 | 4 |
| 1966 | 38 | 181738 | 394 | 123150 | 899 | 139 | 53 | 10 |
| 1972 | 135 | 187615 | 819 | 45218 | 101 | 505 | 396 | 20 |

Source : Statistical Abstract, 1975.

<u>Size of Farm</u> : The size of the farm is positively associated with the application of the improved agricultural practices. "Lionberger and Coughenour have reported that large farms encouraged the use of improved farm practices".[7] According to Malone, "as the size of farm increased there was a tendency to decrease the application of fertiliser per acre".[8] In case of modernised farms the yield of crops, intensity of cropping and productivity of all the crops increase with the increase in the size of holding. All the inputs are more capital intensive in modernised farms than those of traditional fragmented farms. In Burdwan, the farms are fragmented, where 97.3 per cent of the farms are below six hectares in size and none of the farms exceed ten hectares. The cultivators, who grow HYV seeds apply many times more fertiliser than the cultivators who grow traditional varieties of seeds.

<u>Credit</u> : The new technology of agricultural development is capital intensive. Timely investment of credit for purchasing different inputs is an essential item. The institutional credit supply has increased recently. There is much complaint of shortage of credit almost every where throughout the district, specially the small farmers suffering more from the lack of credit. The high yielding varieties of seeds require much more heavy investment and many middle and small farmers are unable to grow these varieties and are unable to apply



ACREAGE & PRODUCTION OF HYV CROPS
HYV PADDY
AREA
PRODUCTION
AREA IN '000 Hectares
PRODUCTION IN '000 Quintals
1966-67
68-69
70-71
72-73
74-75
77-78
HYV WHEAT
AREA IN '000 HECTARES
PRODUCTION IN '000 QUINTALS
66-67
68-69
70-71
72-73
74-75
76-77


Fig. No. 78

the requisite doses of inputs because of lack of capital. Moreover the supply and investment of capital do not reach cultivators in proper time and amount. The important feature of high-yielding variety programme is the intensive use of various inputs which require much capital. But considerable investment and credit supply is unthinkable to small and poor cultivators, who are the backbone of agriculture in the district. Land and capital reform are the necessities for making the green revolution a success.

"The main feature of modern agriculture is the investment on modern inputs like new seeds, fertilisers etc. which are expected to give very high returns, particularly at the initial stages of the introduction of modern technology".[9] The figure shows the acreage and production of high yielding varieties of paddy (Fig. 78 ) and wheat (Fig. 78 ) in Burdwan during 1966-67 to 1977-78. In the case of paddy upto 1969-70, the production had not increased with acreage. After that period the production has increased with acreages. Even in case of wheat the production has increased with acreages. The production should be two or three times greater in case of HYV seeds than the other seeds. But the yield rate of crops is not very high in this district as in the other developing countries, which first initiated the HYV seeds.

An appraisal :

As the traditional varieties of plants are tall, they can resist water-logging and flood damages. The HYV plants on the otherhand get more sunlight, and they are comparatively less prone to attacks by insects and pests than the traditional varieties. The inter-police stations variations in agricultural productions are partly due to differences in quantum of irrigation. Generally the production is hampered due to inadequate rainfall during sowing or growing period. The over-flooding of the fields depletes the soil fertility. Many fields are located at different levels because of undulating topo-graphy. Therefore, it may be necessary to supplement surface water by ground water. The arrangements may be made to store up the surplus water of monsoonal rain in tanks, reservoirs or any where underground for the utilisation of plants during the period of requirement. It is also necessary to develop intensively the canal net work through-out the cultivated field at each and every corner of the district. Sprinkle irrigation may be helpful in maintaining the soil moisture and also in avoiding the wastage of water. In case of HYV-seed more and more irrigation is necessary for the application of chemical fertiliser. But the chemical fertiliser has also a bad effect. The yield of crops rapidly increases just after the application of fertiliser and this

increase continues only for a few years. The fertility of the lands does not remain constant for long years. "An increase in fertiliser use without a corresponding increase in other resources, brings in the operation of the law of diminishing return at an early stage".[10]

For improvement of soil fertility in unirrigated land, intercropping with pulses and legumes should be one of the necessary requirements. Foliar spray of fertilisers is beneficial to avoidance of the wastage. The per hectare use of fertiliser and pesticides in the district is understandably higher among the owner cultivators for their better resources. An alternate application of organic and inorganic fertiliers in soil is much better for maintaining the fertility of soil. The tenants and small farmers hesitate to use fertiliser and pesticide due to its bad effect and their lack of capital. Most of the farmers do not even know the technique of the application of fertiliser and pesticides in terms of quality and quantity. They are unable to get the opportunities of suitable guidance in these matters. There is a harmful effect of pesticide on HYV crops as it pollutes the environment. The main hinderance of application of scientific implements is the availability of cheap labour in Burdwan. "The mechanization, however, has not remained uniform on all

the categories of farms because of differences in the size of holding, adoption of high yielding varieties and acquisition of other resources".[11] The use of machineries is mostly restricted to rich cultivators who can afford the expenditure. The medium and small farmers follow the traditional methods of cultivation. In case of modernised agriculture institutional finance has a great role to play. It should be distributed to all small farmers, who live in debt, at their hour of need. But it is strange that the rich farmers, by and large, get the institutional finance. The rich farmers are benefitted by the new technological innovation, but not the small farmers. As a result, the rich farmers become richer, and the poor, poorer. "An increase in regional disparities in the wake of technological change has been a common feature of agricultural growth in many parts of the world. These disparities derive, partly, from the character of the technological change, and partly, from the regional differences in factor endowments, physical and institutional infrastructure and entrepreneurship."[12] It is a point gathered from an interview with farmers that the production of crops has been increased in areas where the rich farmers cultivate their land with optimum input. They also get high yield of crops. On the other hand, the poor farmers, who cultivate their land by traditional method with inadequate input, produce low yield of crops.

After harvesting of crops, the farmers have to sell a greater part of their paddy at much cheaper rate to liquidate their loans, to buy their essential necessities, while storing the seeds for the next year and with the residual amount they have to eke out their living for the whole year. At the end of the year they have again, to borrow paddy from rich farmers for feeding the family. But the rich farmers store their paddy just after the harvesting time and they lend this paddy at a higher price to the poor farmers. Thus agricultural growth is characterised by widening inequalities both at the regional and at the rich-poor farmer level. Lester Brown remarked about the Green Revolution that "they must use fertiliser in large quantities and use weed-control chemicals 'lest fertilizer be converted into weeds instead of grain'. But the extra costs and efforts are worth it since 'using purchased inputs and marketing additional production, peasant farmers are drawn into the main stream of economic life".[13] The small farmers are not able to obtain all the inputs necessary for high yielding varieties of seeds. Some of the farmers only use HYV seeds in Boro season, and among them a few rich farmers are able to produce high yield crops. There are drawbacks of such cultivation in this district, for most of the farmers are too lazy, too conservative and too illiterate, to adopt the modern techniques. They like to cultivate their field in

traditional method. There is a number of factors, such as, physical, social, economic and political which are responsible for such an unequal agricultural growth in this district. "The thrust of our argument has been that land tenure, market structure and government policy combine in such a way that most of the incentives to innovate are directed towards the large landlord".[14] The physical variation in the district is the western undulated land and eastern plain land. The social variation is the rich farmers and poor farmers among them owner and tenant. Last but not least, there is the political factor which needs no elaboration, for those who have eyes can see them or ears can hear them. The other one, no less important, is the political affiliation of the farmers concerned.

<u>Conclusion</u> :

To conclude it can be said that land reform is very essential for technological innovation in agriculture. It is not an easy solution to increase the productivity and to solve the food problem of millions and millions of hungry mouths. Our mode of production should be adjusted to physical, economic and social structure of the country. The Green Revolution in India is not fully geared to our agrarian structure. Semifeudal production relations operate

as a barrier to the introduction of improved technology"[15] (Bhaduri, 1973).

The consolidation of fragments of land holdings into compact areas should be an important aspect of land policy for both operational economy and production benefits. The consolidation of land ensures the utmost utilisation of land and other available inputs. Intensive cultivation is much easier in a co-operative farming method, which facilitates large scale operations, improved crop rotation system and high productivity of crops. Co-operative farming leads to efficient utilisation of land, judicious use of credit, higher agricultural production and greater employment. Regarding co-operative farming Desh Pande considers that "agricultural producers may co-operate with one another to secure advantages of co-operative buying of agricultural requisites and co-operative selling of agricultural requisites and co-operative selling of agricultural produce, or they may co-operate in order to obtain credit on easier terms".[16] It may be said that the result of joint ploughing, joint use of machinery and joint cultivation is the maximum production per unit of land. But then, as it is, the tractor cannot be fully applied in the district, as it will lead to increasing unemployment - which will rouse opposition.

The remedial measure of unequal production is the judicious distribution of surplus or uncultivated land, adequate credit for purchasing necessary inputs and intensive and proper guidance to the small farmers. A proper care needs to be taken to see that small and marginal farmers are brought with in the ambit of this policy.

Attention should be given to the widening of the scope of research so as to determine which varieties of seeds will be suitable to our agro-climatic zone. The fertilizer should be applied by analysing the soil characteristics, availability of water and the varieties of crops. Organic manure should be applied to the soil for enhancing the fertility of soil for longer period. The most important task for agricultural officers should be equal distribution of credit to small farmers for reducing the disparity between rich and poor farmers. The new technological innovation, as of the present, is suitable for other developing countries, not for our own. The western capitalist countries introduced the High Yielding Variety seeds to Indian soil with an eye to commercial gain to be obtained by selling fertiliser, pesticides etc. It was a known fact to them that HYV seeds require these inputs, which were not produced in India during that time. Even now our country imports fertiliser, pesticides from western countries. Inspite of all this, the yield rate is not so high as in

other countries due to inadequacy and uncertainty of irrigation. It was also known to them that our irrigation system was not fool-proof. Susan George argued, "Western interests introduced the Revolution to sell inputs, but also to promote social stability through increased food production and the strengthening of a middle-class peasantry in nations they saw as threatened by 'communism'. Now it turns out that everywhere the Green Revolution has established the truth that agriculture is not merely the means for feeding people but also a 'profitable investment ...... which sets in motion deep currents of change in the relation between land, labour and capitall between owners, tenants and labourers, between agriculture, commerce and industry, and between town and country."[17] Fifteen years have passed after the introduction of new technology and the optimum results are yet to come. It is necessary that we take to breeding new varieties of seeds which are adapted to our topography, soil, climate, economy and social and political setup for the simple reason that an economic revolution always requires a supportive socio-economic structure to make it a success.

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Intensive Agricultural District Programme, Burdwan.

# CHAPTER-VIII

## PROBLEMS AND SUGGESTIONS

Since Independence, the infrastructure of agriculture in Burdwan has undergone significant changes, for the better, yet there is considerable scope for redevelopment of agriculture in the district. At most a dent has been made in the age-old agricultural stagnation of the district, as the country as a whole. Land reform is an essential pre-requisite for technological innovation in agriculture. The agricultural condition of India today is a composite of the old-subsistence-farming and the new-modernised-farming. The total picture at present is one of some growth interspersed with modernisation, that has unfortunately left unaffected majority of farmers, leaving them as poor and workless as ever. The strategy ~~of~~ of agricultural productivity, as applied here, is not adequate enough to cope with the rising demand for food grains and other products.

The impact of the so-called "Green Regolution" has not been very remarkable in all parts of the country both in terms of acreage and output. The future scope also is very much limited, if things proceed in the present happy-go-lucky way. In the agricultural revolution Punjab and Haryana have achieved some success and that too in respect of wheat

production. All the favourable factors for wheat production are present in Punjab, Haryana, which helped these States to produce more and more wheat. In the case of West Bengal, the agricultural revolution was attempted during 1967-68, with the result that production increased as compared with the past but not in proportion to the inputs employed. The output is far below the optimum levels as compared to experimental result. In case of high yielding variety seed more and more irrigation is necessary for the application of chemical fertiliser. It is also necessary to develop intensively the canal net work throughout the cultivated field in each and every corner of the district of Burdwan. Besides,the fertilizer should be applied by analysing the soil characteristics keeping in view availability of water and the varieties of crops. An alternate application of organic and inorganic fertiliser in soil is much better for maintaining the fertility of soil. The tenants and small farmers hesitate to use fertiliser and pesticide due to their ignorance of the technique of their application, their lack of capital and their apprehensions about the bad effects of those inputs. They do not get the opportunities of suitable guidance either in these matters. The major contributing factors for high yield potentials are optimum utilisation of solar energy for the prevention of pests

and diseases. But the two inputs, energy and water, are not available at the same time in the district. Then also, there is complaint about shortage of credit almost everywhere throughout the district, specially among the small farmers. The high yielding varieties of seeds require relatively heavy investment and many middle and small farmers are unable to grow these varieties simply because they are unable to apply the requisite doses of inputs because of financial constraints. No doubt the production of crops has since increased considerably but in areas where the rich farmers cultivate their land with optimum inputs. On the other hand, the poor farmers, who cultivate their land by traditional methods with inadequate inputs, have to remain content with a low yield of crops.

Improvement in production can be achieved by increasing land productivity on existing lands or by expanding that total area of arable land and utilising it. The cultivator may be induced to grow drought resistant varieties of crops, which are suitable for the arid region such as, high yielding jowar, bajra, maize, pulses, gram etc.
An essential requirement of multiple cropping is availability of short duration varieties of crops. Rulses may be grown after the cultivation of paddy. Land can be profitably utilized as well as fertility of land can be

maintained for raising second and third crops such as pulses and oilseeds. There are many lands which remain fallow throughout the year in the western part of the district and the monocropped land remains fallow about half of the year for scarcity of water. Such wastage of land is criminal in our poor country, to say the least of it. Many types of dry food grains can be cultivated in the fallow land as not much water is needed for the purpose. Among the non-food grains, various types of grasses, forage crops and trees can be planted as commercial or cash crops. To grow double and triple crops throughout the district, tube wells, wells and tanks should be constructed in the areas concerned. Within the surface-water command area, where irrigation water cannot be provided, during the Rabi seasons, tube wells and wells may be constructed to supplement surface water for plots beyond the reach of canal water. Specially, in the western part of the district, tube wells, wells, and tanks of depths greater than that required in the eastern part and in the adjoining areas of rivers are to be constructed.
Another point to note is that a large amount of water is wasted by over flooding during rain from the rivers and tanks. It is necessary, to save such water from wastage and to utilise it. The thing is that we should develop habits of self reliance and not pathetically go about with begging bowls at all times.

It has been suggested that co-operative farming is the only sensible alternative if India is to achieve speedy progress in rural development. No doubt large scale co-operative farming in our country is not an easy task, because of the psychological attachment of the farmers to their small holdings. But it can be said, without fear of contradiction, that co-operative farmings provides a social security cover to all the farmers and their families. In this type of farming agricultural producers may co-operate with one another to secure advantages of co-operative buying of agricultural inputs, co-operative selling of agricultural produce and they may co-operate as well to obtain credit easily. It can be said that co-operative ploughing. Co-operative harvesting, joint use of machinery, and joint arrangements for watch and ward save land, labour, capital, wastage of inputs etc. Co-operativisation leads, to higher agricultural production, larger income, greater employment and desirable shifts in the pattern of agricultural production from simple arable farming to more diversified farming. Such type of farming assures low cost and highest earnings and the optimum utilisation of farm resources.

It is essential that the growth of small scale industries, agricultural equipment making industries, agrobased industries be promoted, in order to provide more

employment opportunities. Besides, the method of agricultural production should be followed in a mechanised way. It is necessary today to ensure communication of modern technological knowledge and latest proven findings of research in agriculture to farmers through modern methods of extension and to that end strengthening and stream-lining of the extension organisation. It is necessary to train and guide the farmers along the right line by district agricultural department.

The consolidation of fragments of land holdings to compact areas should be an important aspect of land policy for both operational economy and production benefits. Co-operativisation leads to efficient utilisation of land, ensures improved crop rotation system, judicious use of credit, higher agricultural production and greater employment. An important task for today is the most rational use of land to ensure increasing productivity, per unit time. What is required is the supply of high quality seed and other essential inputs to meet the needs of the farmers for higher productivity and also to make adequate agricultural credit available to the farmers from the nationalised banks and co-operatives. The supply of credit and other required inputs should reach timely each and every corner of the village and those inputs must be equally distributed to the

rich and poor farmers. Further, it is necessary to reduce the dependency on foreign aids and resources and to build roads and markets of suitable, fixed price in each and every village.

The Green Revolution in India is not fully geared to our agrarian structure. This new agricultural technology is more adapted to foreign countries, where the innovations were started rather than to India. The technique of agricultural production in our country is somewhat different from that of other developing countries. Immediate steps should be taken to breed new high yielding varieties of seed which are suited to our topography, soil, climate, socio-economic and political set up. Japanese agriculture is a good example where modern and traditional inputs have continued to be used with small sized land holdings to obtain higher output at moderate costs. It may be suggested that a judicious mix of modern and traditional technology offers a better promise at this stage of development of our country. To conclude, it can be said that the terminology "Green Revolution" as it is commonly known in foreign countries is not strictly applicable to our poor country. In fact Green Revolution has not been a success in the true sense of the term in the district of Burdwan in particular.

In fine, a good suggestion can be made for the overall development of agriculture in Burdwan. As we know, there is a proverb that Burdwan district is the "granary of West Bengal". No doubt that it is the result of many favourable factors contributing to the growth of agriculture in this particular district more than the other districts of West Bengal. Although many plans and programmes have already been undertaken to utilize the agricultural resources of this area, there is great potentiality for augmenting production. The vast agricultural area of Burdwan with its favourable conditions needs increasing exploitation by the planners and agricultural scientists and specially the Government with a view to promoting its growth so that the district could feed its people in an ever increasing manner. It is up to us all who have the interests of the district at heart to give of our best so that Burdwan may justify its claim to be called the "Granary of the Country".

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$73\frac{I}{13}$, $\frac{I}{14}$

$73\frac{M}{1}$, $\frac{M}{2}$, $\frac{M}{6}$, $\frac{M}{7}$, $\frac{M}{10}$, $\frac{M}{11}$, $\frac{M}{12}$, $\frac{M}{13}$, $\frac{M}{14}$, $\frac{M}{15}$, $\frac{M}{16}$

$73\frac{N}{9}$, $\frac{N}{13}$

$79\frac{A}{2}$, $\frac{A}{3}$, $\frac{A}{4}$, $\frac{A}{6}$, $\frac{A}{8}$.

$79\frac{B}{1}$

# APPENDICES

## TABLE 2

Relative relief, slope and drainage density (Gridwise) in Burdwan District

| Grid No. | Height in meter | | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| | Maximum | Minimum | | | |
| 1 | 185 | 160 | 25 | 4.0 | 0.5 |
| 2 | 150 | 125 | 25 | 4.0 | 0.25 |
| 3 | 140 | 110 | 30 | 3.2 | 0.5 |
| 4 | 170 | 140 | 30 | 0.6 | 0.5 |
| 5 | 160 | 140 | 20 | 1.1 | 0.5 |
| 6 | 145 | 125 | 20 | 1.6 | 1.0 |
| 7 | 135 | 115 | 20 | 2.3 | 1.0 |
| 8 | 120 | 100 | 20 | 4.5 | 1.0 |
| 9 | 170 | 150 | 20 | 6.6 | 1.0 |
| 10 | 180 | 140 | 40 | 1.7 | 1.0 |
| 11 | 150 | 120 | 30 | 2.3 | 1.0 |
| 12 | 135 | 105 | 30 | 1.7 | 0.75 |
| 13 | 120 | 95 | 25 | 1.7 | 0.5 |
| 14 | 170 | 110 | 60 | 1.3 | 0.75 |
| 15 | 165 | 120 | 45 | 2.6 | 1.0 |
| 16 | 150 | 120 | 30 | 3.8 | 0.5 |
| 17 | 125 | 100 | 25 | 5.3 | 0.5 |
| 18 | 110 | m90 | 20 | 2.8 | 1.0 |
| 19 | 120 | 100 | 20 | 1.5 | 1.0 |
| 20 | 150 | 100 | 50 | 1.5 | 0.5 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq. mile) |
|---|---|---|---|---|---|
| 21 | 150 | 120 | 30 | 3.6 | 0 |
| 22 | 125 | 100 | 25 | 2.3 | 0 |
| 23 | 110 | 85 | 25 | 2.3 | 0 |
| 24 | 100 | 75 | 25 | 1.9 | 1.0 |
| 25 | 110 | 90 | 20 | 3.6 | 0.5 |
| 26 | 120 | 90 | 30 | 1.7 | 1.0 |
| 27 | 115 | 90 | 25 | 2.3 | 0 |
| 28 | 100 | 80 | 20 | 1.5 | 1.5 |
| 29 | 90 | 70 | 20 | 3.2 | 0.5 |
| 30 | 115 | 90 | 25 | 2.1 | 1.0 |
| 31 | 125 | 100 | 25 | 2.6 | 0 |
| 32 | 115 | 95 | 20 | 2.1 | 0 |
| 33 | 100 | 90 | 20 | 1.5 | 0 |
| 34 | 110 | 95 | 15 | 0.8 | 0 |
| 35 | 110 | 105 | 15 | 1.1 | 1.0 |
| 36 | 120 | 90 | 20 | 0.7 | 0 |
| 37 | 110 | 90 | 20 | 2.6 | 1.5 |
| 38 | 115 | 90 | 15 | 2.3 | 0 |
| 39 | 105 | 90 | 15 | 1.9 | 0.75 |
| 40 | 105 | 90 | 15 | 1.1 | 1.0 |
| 41 | 105 | 90 | 15 | 1.0 | 0 |

| Grid No. | Height in meter | | Relative relief | Slope in degree | Drainage density (per sq. mile) |
|---|---|---|---|---|---|
| | Maximum | Minimum | | | |
| 42 | 110 | 85 | 20 | 1.9 | 0 |
| 43 | 105 | 80 | 20 | 1.3 | 0 |
| 44 | 95 | 80 | 15 | 1.3 | 0 |
| 45 | 100 | 80 | 20 | 1.7 | 0 |
| 46 | 100 | 80 | 20 | 1.5 | 0 |
| 47 | 100 | 80 | 20 | 1.1 | 0.5 |
| 48 | 100 | 80 | 20 | 1.1 | 1.0 |
| 49 | 95 | 80 | 15 | 0.8 | 0.5 |
| 50 | 80 | 65 | 15 | 1.9 | 0 |
| 51 | 95 | 80 | 15 | 3.0 | 0 |
| 52 | 80 | 60 | 20 | 2.3 | 1.5 |
| 53 | 80 | 60 | 20 | 2.6 | 1.0 |
| 54 | 60 | 60 | 0 | 1.9 | 0 |
| 55 | 65 | 65 | 0 | 1.3 | 0 |
| 56 | 80 | 65 | 15 | 1.3 | 0 |
| 57 | 80 | 60 | 20 | 0.8 | 0 |
| 58 | 80 | 65 | 15 | 0.8 | 0 |
| 59 | 80 | 60 | 20 | 2.6 | 0 |
| 60 | 75 | 60 | 15 | 2.6 | 0 |
| 61 | 80 | 65 | 15 | 1.3 | 0.75 |
| 62 | 80 | 65 | 15 | 2.6 | 0.75 |
| 63 | 75 | 60 | 15 | 1.3 | 1.0 |
| 64 | 80 | 65 | 15 | 1.3 | 0.5 |
| 65 | 80 | 65 | 15 | 0.8 | 1.0 |
| 66 | 80 | 65 | 15 | 1.9 | 0 |
| 67 | 70 | 60 | 10 | 1.3 | 0 |
| 68 | 75 | 60 | 15 | 1.7 | 0. |
| 69 | 75 | 60 | 15 | 1.9 | 0.25 |
| 70 | 65 | 50 | 15 | 1.5 | 0 |
| 71 | 80 | 55 | 25 | 2.1 | 0.5 |
| 72 | 80 | 65 | 15 | 1.9 | 1.0 |

| Grid No. | Height in meter | | Relative relief | Slope in degree | Drainage density (per sq. mile) |
|---|---|---|---|---|---|
| | Maximum | Minimum | | | |
| 73 | 70 | 60 | 10 | 2.1 | 0.25 |
| 74 | 65 | 55 | 10 | 2.6 | 9.75 |
| 75 | 70 | 55 | 15 | 1.3 | 0.5 |
| 76 | 0 | 0 | 0 | 0.8 | 0 |
| 77 | 55 | 55 | 0 | 2.1 | 0 |
| 78 | 70 | 55 | 15 | 1.3 | 0 |
| 79 | 60 | 50 | 10 | 1.1 | 0 |
| 80 | 65 | 50 | 15 | 1.5 | 0 |
| 81 | 75 | 60 | 15 | 1.3 | 0 |
| 82 | 65 | 55 | 10 | 1.1 | 1.0 |
| 83 | 65 | 55 | 10 | 1.5 | 1.0 |
| 84 | 55 | 55 | 0 | 2.1 | 0.75 |
| 85 | 55 | 55 | 0 | 1.1 | 0.5 |
| 86 | 55 | 55 | 0 | 1.3 | 0 |
| 87 | 50 | 50 | 0 | 2.6 | 1.0 |
| 88 | 60 | 45 | 15 | 3.0 | 0.75 |
| 89 | 45 | 45 | 0 | 3.2 | 1.0 |
| 90 | 60 | 60 | 0 | 1.3 | 2.5 |
| 91 | 75 | 60 | 15 | 0.8 | 1.5 |
| 92 | 70 | 55 | 15 | 1.5 | 1.75 |
| 93 | 60 | 50 | 10 | 2.1 | 2.0 |
| 94 | 70 | 55 | 15 | 1.9 | 0.5 |
| 95 | 65 | 50 | 15 | 1.5 | 0 |
| 96 | 65 | 50 | 15 | 2.1 | 0 |
| 97 | 65 | 50 | 15 | 3.0 | 0.5 |
| 98 | 50 | 50 | 0 | 1.3 | 1.0 |
| 99 | 60 | 45 | 15 | 1.7 | 1.5 |
| 100 | 45 | 45 | 0 | 1.3 | 1.0 |
| 101 | 60 | 45 | 15 | 1.5 | 0.5 |
| 102 | 65 | 50 | 15 | 1.1 | 2.0 |
| 103 | 65 | 50 | 15 | 1.5 | 1.0 |

| Grid No. | Height in meter | | Relative relief | Slope in degree | Drainage density (per sq. mile) |
|---|---|---|---|---|---|
| | Maximum | Minimum | | | |
| 104 | 70 | 45 | 15 | 1.7 | 0.5 |
| 105 | 70 | 45 | 15 | 0.8 | 1.0 |
| 106 | 50 | 50 | 0 | 0.8 | 0.5 |
| 107 | 50 | 50 | 0 | 2.1 | 0.5 |
| 108 | 50 | 50 | 0 | 2.1 | 0.75 |
| 109 | 50 | 50 | 0 | 1.1 | 0 |
| 110 | 45 | 45 | 0 | 1.5 | 0.25 |
| 111 | 40 | 40 | 0 | 1.3 | 0 |
| 112 | 45 | 45 | 0 | 2.6 | 1.25 |
| 113 | 55 | 40 | 15 | 1.9 | 0.75 |
| 114 | 0 | 0 | 0 | 2.6 | 0 |
| 115 | 45 | 45 | 0 | 1.7 | 0 |
| 116 | 50 | 50 | 0 | 0.8 | 0 |
| 117 | 50 | 50 | 0 | 1.7 | 1.5 |
| 118 | 55 | 40 | 15 | 0.6 | 2.0 |
| 119 | 50 | 40 | 10 | 1.3 | 1.0 |
| 120 | 45 | 45 | 0 | 1.5 | 1.5 |
| 121 | 0 | 0 | p | 1.9 | 0.25 |
| 122 | 45 | 45 | 0 | 1.5 | 0 |
| 123 | 45 | 45 | 0 | 2.8 | 0 |
| 124 | 55 | 40 | 15 | 1.7 | 1.5 |
| 125 | 55 | 40 | 15 | 1.7 | 0.25 |
| 126 | 45 | 45 | 0 | 1.9 | 0 |
| 127 | 45 | 45 | 0 | 1.1 | 0 |
| 128 | 55 | 40 | 15 | 1.1 | 1.0 |
| 129 | 40 | 40 | 0 | 1.5 | 1.75 |
| 130 | 55 | 40 | 15 | 1.3 | 0 |
| 131 | 45 | 35 | 10 | 1.3 | 0 |
| 132 | 55 | 40 | 15 | 1.7 | 0 |
| 133 | 55 | 40 | 15 | 2,1 | 1.0 |
| 134 | 55 | 40 | 15 | 1.5 | 3.75 |

| Grid No. | Height in meter | | Relative relief | Slope in degree | Drainage density (per sq. mile) |
|---|---|---|---|---|---|
| | Maximum | Minimum | | | |
| 135 | 40 | 40 | 0 | 0.8 | 0.5 |
| 136 | 45 | 45 | 0 | 1.7 | 1.75 |
| 137 | 45 | 45 | 0 | 2.1 | 2.25 |
| 138 | 45 | 45 | 0 | 2.6 | 0.5 |
| 139 | 45 | 45 | 0 | 1.1 | 0.25 |
| 140 | 55 | 40 | 15 | 1.3 | 1.25 |
| 141 | 0 | 0 | 0 | 0.8 | 0 |
| 142 | 55 | 40 | 15 | 1.7 | 0.25 |
| 143 | 55 | 40 | 15 | 1.9 | 1.0 |
| 144 | 45 | 35 | 10 | 0.8 | 0 |
| 145 | 45 | 35 | 10 | 1.3 | 0 |
| 146 | 35 | 35 | 0 | 1.7 | 1.0 |
| 147 | 35 | 35 | 0 | 2.1 | 1.0 |
| 148 | 50 | 35 | 15 | 1.7 | 0 |
| 149 | 50 | 35 | 15 | 1.7 | 0 |
| 150 | 40 | 40 | 0 | 1.9 | 0.5 |
| 151 | 40 | 40 | 0 | 1.5 | 3.0 |
| 152 | 40 | 40 | 0 | 0.6 | 1.5 |
| 153 | 40 | 40 | 0 | 2.3 | 2.0 |
| 154 | 40 | 40 | 0 | 1.9 | 1.75 |
| 155 | 40 | 40 | 0 | 2.1 | 1.0 |
| 156 | 0 | 0 | 0 | 1.3 | 0 |
| 157 | 35 | 35 | 0 | 1.3 | 1.5 |
| 158 | 35 | 35 | 0 | 1.3 | 0 |
| 159 | 35 | 35 | 0 | 1.1 | 0 |
| 160 | 60 | 45 | 15 | 1.5 | 0.5 |
| 161 | 55 | 45 | 10 | 1.1 | 2.0 |
| 162 | 55 | 45 | 10 | 0.8 | 2.0 |
| 163 | 55 | 45 | 10 | 0.8 | 1.25 |
| 164 | 60 | 45 | 15 | 0.6 | 2.0 |
| 165 | 60 | 45 | 15 | 1.3 | 0 |

| Grid No. | Height in meter | | Relative relief | Slope in degree | Drainage density (per sq. mile) |
|---|---|---|---|---|---|
| | Maximum | Minimum | | | |
| 166. | 0 | 0 | 0 | 1.5 | 0 |
| 167 | 0 | 0 | 0 | 2.1 | 1.0 |
| 168 | 0 | 0 | 0 | 2.1 | 1.5 |
| 169 | 45 | 45 | 0 | 0.6 | 1.0 |
| 170 | 0 | 0 | 0 | 1.7 | 1.5 |
| 171 | 55 | 45 | 10 | 2.6 | 1.0 |
| 172 | 0 | 0 | 0 | 2.6 | 0 |
| 173 | 0 | 0 | 0 | 1.9 | 0.5 |
| 174 | 45 | 45 | 0 | 1.1 | 1.0 |
| 175 | 45 | 45 | 0 | 1.1 | 1.5 |
| 176 | 45 | 45 | 0 | 0.8 | 0 |
| 177 | 45 | 45 | 0 | 1.1 | 0 |
| 178 | 45 | 45 | 0 | 0.4 | 0 |
| 179 | 60 | 45 | 15 | 0.8 | 1.5 |
| 180 | 0 | 0 | 0 | 0.4 | 2.5 |
| 181 | 0 | 0 | 0 | 1.1 | 0.5 |
| 182 | 0 | 0 | 0 | 1.7 | 0 |
| 183 | 0 | 0 | 0 | 1.1 | 0 |
| 184 | 0 | 0 | 0 | 0.8 | 1.0 |
| 185 | 0 | 0 | 0 | 0.8 | 1.75 |
| 186 | 40 | 40 | 0 | 2.1 | 1.0 |
| 187 | 55 | 40 | 15 | 2.1 | 0 |
| 188 | 45 | 45 | 0 | 1.5 | 0 |
| 189 | 0 | 0 | 0 | 1.1 | 0.75 |
| 190 | 0 | 0 | 0 | 1.3 | 0 |
| 191 | 60 | 45 | 15 | 1.1 | 0 |
| 192 | 60 | 45 | 15 | 0.6 | 0 |
| 193 | 40 | 40 | 0 | 0.4 | 0 |
| 194 | 55 | 40 | 15 | 1.3 | 0 |
| 195 | 40 | 40 | 0 | 1.1 | 0.25 |
| 196 | 40 | 40 | 0 | 1.3 | 0 |
| 197 | 0 | 0 | 0 | 2.1 | 1.0 |

| Grid No. | Height in meter |  | Relative relief | Slope in degree | Drainage density (per sq. mile) |
|---|---|---|---|---|---|
|  | Maximum | Minimum |  |  |  |
| 198 | 0 | 0 | 0 | 2.3 | 0 |
| 199 | 0 | 0 | 0 | 1.9 | 0.25 |
| 200 | 55 | 40 | 15 | 1.5 | 1.75 |
| 201 | 40 | 40 | 0 | 1.1 | 3.0 |
| 202 | 55 | 40 | 15 | 1.1 | 0.75 |
| 203 | 55 | 40 | 15 | 1.7 | 2.25 |
| 204 | 50 | 40 | 10 | 1.7 | 0.5 |
| 205 | 55 | 40 | 15 | 0.8 | 1.25 |
| 206 | 55 | 40 | 15 | 1.5 | 1.0 |
| 207 | 40 | 40 | 0 | 1.3 | 2.5 |
| 208 | 40 | 40 | 0 | 0.8 | 2.0 |
| 209 | 40 | 40 | 0 | 1.1 | 1.25 |
| 210 | 40 | 40 | 0 | 0.4 | 1.0 |
| 211 | 55 | 45 | 10 | 1.7 | 0.75 |
| 212 | 45 | 45 | 0 | 1.9 | 0 |
| 213 | 45 | 45 | 0 | 1.1 | 0.5 |
| 214 | 55 | 40 | 15 | 1.3 | 1.0 |
| 215 | 55 | 40 | 15 | 0.6 | 0 |
| 216 | 45 | 45 | 0 | 1.1 | 0 |
| 217 | 40 | 40 | 0 | 3.6 | 1.0 |
| 218 | 55 | 40 | 15 | 2.8 | 2.0 |
| 219 | 60 | 45 | 15 | 1.7 | 1.0 |
| 220 | 55 | 40 | 15 | 2.3 | 0.5 |
| 221 | 55 | 40 | 15 | 1.1 | 0 |
| 222 | 40 | 40 | 0 | 1.5 | 0 |
| 223 | 40 | 40 | 0 | 2.1 | 2.0 |
| 224 | 40 | 40 | 0 | 1.7 | 1.5 |
| 225 | 40 | 40 | 0 | 1.3 | 0.5 |
| 226 | 60 | 45 | 15 | 1.1 | 1.0 |
| 227 | 60 | 45 | 15 | 1.7 | 0.25 |
| 228 | 45 | 45 | 0 | 1.1 | 1.0 |
| 229 | 55 | 45 | 10 | 1.3 | 2.5 |
| 230 | 60 | 45 | 15 | 2.1 | 1.25 |

| Grid No. | Height in meter | | Relative relief | Slope in degree | Drainage density (per sq. mile) |
|---|---|---|---|---|---|
| | Maximum | Minimum | | | |
| 231 | 60 | 45 | 15 | 1.5 | 0 |
| 232 | 45 | 45 | 0 | 0.4 | 0.5 |
| 233 | 45 | 45 | 0 | 1.9 | 1.0 |
| 234 | 60 | 45 | 15 | 1.7 | 0.75 |
| 235 | 60 | 45 | 15 | 1.5 | 0.75 |
| 236 | 55 | 45 | 10 | 2.6 | 0.5 |
| 237 | 60 | 45 | 15 | 2.8 | 0 |
| 238 | 60 | 45 | 15 | 1.7 | 0 |
| 239 | 55 | 45 | 10 | 1.1 | 0.25 |
| 240 | 40 | 40 | 0 | 1.5 | 1.25 |
| 241 | 40 | 40 | 0 | 0.8 | 1.5 |
| 242 | 60 | 45 | 15 | 1.9 | 1.5 |
| 243 | 40 | 40 | 0 | 1.3 | 0 |
| 244 | 45 | 45 | 0 | 0.8 | 1.25 |
| 245 | 45 | 45 | 0 | 0.8 | 0.25 |
| 246 | 45 | 45 | 0 | 1.5 | 0.25 |
| 247 | 45 | 45 | 0 | 1.7 | 1.25 |
| 248 | 45 | 45 | 0 | 1.9 | 0 |
| 249 | 45 | 45 | 0 | 1.1 | 1.0 |
| 250 | 45 | 45 | 0 | 0.8 | 1.0 |
| 251 | 60 | 45 | 15 | 2.1 | 0 |
| 252 | 60 | 45 | 15 | 1.7 | 0 |
| 253 | 55 | 40 | 15 | 1.5 | 0 |
| 254 | 55 | 40 | 15 | 0.8 | 0 |
| 255 | 55 | 40 | 15 | 0.8 | 0 |
| 256 | 55 | 40 | 15 | 1.5 | 0 |
| 257 | 40 | 40 | 0 | 1.9 | 1.0 |
| 258 | 40 | 40 | 0 | 1.7 | 0.5 |
| 259 | 60 | 45 | 15 | 1.3 | 1.0 |
| 260 | 40 | 40 | 0 | 0.6 | 0 |

| Grid No. | Height in meter | | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| | Maximum | Minimum | | | |
| 261 | 45 | 45 | 0 | 0.8 | 0 |
| 262 | 45 | 45 | 0 | 2.1 | 1.0 |
| 263 | 45 | 45 | 0 | 1.9 | 2.0 |
| 264 | 45 | 45 | 0 | 0.4 | 1.5 |
| 265 | 0 | 0 | 0 | 0 | 1.0 |
| 266 | 45 | 45 | 0 | 0.4 | 0.75 |
| 267 | 60 | 45 | 0 | 1.3 | 1.5 |
| 268 | 60 | 45 | 0 | 1.5 | 1.0 |
| 269 | 60 | 45 | 0 | 1.5 | 0 |
| 270 | 60 | 45 | 0 | 1.3 | 0 |
| 271 | 55 | 40 | 15 | 1.1 | 0 |
| 272 | 45 | 45 | 0 | 1.1 | 0 |
| 273 | 55 | 40 | 15 | 2.3 | 0 |
| 274 | 55 | 40 | 15 | 1.7 | 1.0 |
| 275 | 40 | 40 | 0 | 0.6 | 0 |
| 276 | 40 | 40 | 0 | 0.6 | 0 |
| 277 | 40 | 40 | 0 | 0.8 | 2.0 |
| 278 | 60 | 45 | 15 | 0.8 | 0 |
| 279 | 45 | 45 | 0 | 1.9 | 1.5 |
| 280 | 45 | 45 | 0 | 1.3 | 2.0 |
| 281 | 0 | 0 | 0 | 0 | 1.0 |
| 282 | 60 | 45 | 15 | 1.9 | 1.0 |
| 283 | 40 | 40 | 0 | 0.8 | 1.0 |
| 284 | 40 | 40 | 0 | 0.6 | 0.5 |
| 285 | 60 | 45 | 15 | 1.7 | 0.75 |
| 286 | 60 | 45 | 15 | 1.7 | 0 |
| 287 | 40 | 40 | 0 | 1.5 | 0 |
| 288 | 40 | 40 | 0 | 1.1 | 0 |
| 289 | 60 | 45 | 15 | 1.7 | 0 |
| 290 | 40 | 40 | 0 | 1.1 | 0 |
| 291 | 60 | 45 | 15 | 0.8 | 0 |
| 292 | 40 | 40 | 0 | 0.4 | 0.5 |

| Grid No. | Height in meter | | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| | Maximum | Minimum | | | |
| 293 | 40 | 40 | 0 | 0.8 | 0.5 |
| 294 | 40 | 40 | 0 | 1.3 | 0 |
| 295 | 60 | 45 | 15 | 2.6 | 0 |
| 296 | 60 | 45 | 15 | 1.3 | 0.5 |
| 297 | 45 | 45 | 0 | 0.4 | 1.5 |
| 298 | 45 | 45 | 0 | 0.4 | 1.0 |
| 299 | 60 | 45 | 15 | 1.3 | 0.75 |
| 300 | 60 | 45 | 15 | 1.1 | 0 |
| 301 | 50 | 45 | 5 | 1.7 | 0.5 |
| 302 | 40 | 40 | 0 | 1.5 | 0 |
| 303 | 50 | 45 | 5 | 1.3 | 0.5 |
| 304 | 40 | 40 | 0 | 1.9 | 0 |
| 305 | 40 | 40 | 0 | 2.3 | 0.5 |
| 306 | 40 | 40 | 0 | 1.5 | 0 |
| 307 | 40 | 40 | 0 | 0.8 | 0 |
| 308 | 45 | 45 | 0 | 1.7 | 0 |
| 309 | 45 | 45 | 0 | 1.5 | 0 |
| 310 | 50 | 45 | 5 | 2.1 | 1.0 |
| 311 | 45 | 45 | 0 | 1.5 | 1.0 |
| 312 | 45 | 45 | 0 | 0 | 1.0 |
| 313 | 45 | 45 | 0 | 0.4 | 0.75 |
| 314 | 45 | 45 | 0 | 0.4 | 0.25 |
| 315 | 50 | 40 | 10 | 0.6 | 1.0 |
| 316 | 50 | 50 | 0 | 1.5 | 0 |
| 317 | 50 | 45 | 5 | 0.6 | 0.75 |
| 318 | 50 | 40 | 10 | 0.6 | 2.0 |
| 319 | 50 | 40 | 10 | 0.8 | 1.75 |
| 320 | 50 | 40 | 10 | 0.8 | 0 |
| 321 | 50 | 50 | 0 | 0.4 | 0 |
| 322 | 50 | 40 | 10 | 1.5 | 1.0 |
| 323 | 50 | 40 | 10 | 1.7 | 0 |
| 324 | 50 | 40 | 10 | 1.5 | 0 |

| Grid No. | Height in meter | | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| | Maximum | Minimum | | | |
| 325 | 45 | 45 | 0 | 1.5 | 0 |
| 326 | 50 | 40 | 10 | 1.5 | 0.75 |
| 327 | 45 | 45 | 0 | 1.3 | 1.0 |
| 328 | 50 | 40 | 10 | 1.5 | 0 |
| 329 | 50 | 40 | 10 | 2.1 | 0 |
| 330 | 50 | 40 | 10 | 0.8 | 0 |
| 331 | 50 | 50 | 0 | 0.4 | 0 |
| 332 | 50 | 50 | 0 | 1.3 | 1.75 |
| 333 | 55 | 45 | 10 | 1.3 | 1.25 |
| 334 | 55 | 45 | 10 | 1.5 | 0.5 |
| 335 | 55 | 45 | 10 | 1.3 | 1.0 |
| 336 | 55 | 45 | 10 | 2.3 | 0 |
| 337 | 45 | 45 | 0 | 1.5 | 1.0 |
| 338 | 55 | 45 | 10 | 1.7 | 1.5 |
| 339 | 45 | 45 | 0 | 1.9 | 1.75 |
| 340 | 45 | 45 | 0 | 0.4 | 1.5 |
| 341 | 45 | 45 | 0 | 0.8 | 1.0 |
| 342 | 45 | 45 | 0 | 1.3 | 0 |
| 343 | 55 | 45 | 10 | 3.4 | 0 |
| 344 | 55 | 45 | 10 | 2.3 | 0 |
| 345 | 50 | 50 | 0 | 0.4 | 0 |
| 346 | 50 | 50 | 0 | 0.4 | 0 |
| 347 | 50 | 50 | 0 | 0.4 | 0.5 |
| 348 | 45 | 45 | 0 | 0.8 | 2.5 |
| 349 | 45 | 45 | 0 | 1.3 | 3.0 |
| 350 | 55 | 45 | 10 | 1.5 | 1.5 |
| 351 | 55 | 45 | 10 | 0.8 | 1.0 |
| 352 | 55 | 45 | 10 | 0.8 | 1.25 |
| 353 | 45 | 45 | 0 | 1.5 | 1.0 |
| 354 | 45 | 45 | 0 | 0.6 | 1.5 |
| 355 | 45 | 45 | 0 | 0.4 | 1.0 |
| 356 | 45 | 45 | 0 | 0.6 | 1.5 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 357 | 55 | 45 | 10 | 2.8 | 0 |
| 358 | 60 | 45 | 15 | 2.1 | 0 |
| 359 | 50 | 50 | 0 | 0.6 | 1.0 |
| 360 | 50 | 50 | 0 | 0.4 | 1.5 |
| 361 | 50 | 50 | 0 | 1.1 | 0.5 |
| 362 | 60 | 45 | 15 | 0.8 | 2.0 |
| 363 | 60 | 45 | 15 | 1.9 | 2.25 |
| 364 | 45 | 45 | 0 | 0.4 | 0.5 |
| 365 | 55 | 45 | 10 | 0.6 | 2.0 |
| 366 | 45 | 45 | 0 | 1.1 | 0 |
| 367 | 45 | 45 | 0 | 1.1 | 0 |
| 368 | 45 | 45 | 0 | 0.8 | 1.0 |
| 369 | 0 | 0 | 0 | 0 | 1.0 |
| 370 | 45 | 45 | 0 | 0.4 | 1.25 |
| 371 | 55 | 45 | 10 | 2.8 | 0 |
| 372 | 55 | 45 | 10 | 1.3 | 0 |
| 373 | 45 | 45 | 0 | 0.8 | 0.25 |
| 374 | 45 | 45 | 0 | 0.4 | 0 |
| 375 | 45 | 45 | 0 | 0.6 | 0.25 |
| 376 | 45 | 45 | 0 | 1.9 | 2.0 |
| 377 | 45 | 45 | 0 | 3.0 | 1.5 |
| 378 | 55 | 45 | 10 | 1.7 | 2.0 |
| 379 | 55 | 45 | 10 | 1.7 | 1.5 |
| 380 | 45 | 45 | 0 | 1.9 | 2.0 |
| 381 | 45 | 45 | 0 | 1.3 | 0.25 |
| 382 | 45 | 45 | 0 | 1.3 | 1.5 |
| 383 | 0 | 0 | 0 | 0 | 1.0 |
| 384 | 45 | 45 | 0 | 0.4 | 1.5 |
| 385 | 55 | 45 | 10 | 2.6 | 1.0 |
| 386 | 55 | 45 | 10 | 1.7 | 0.5 |
| 387 | 55 | 45 | 10 | 1.5 | 0 |
| 388 | 50 | 50 | 0 | 0.8 | 1.0 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 389 | 50 | 50 | 0 | 0.4 | 0 |
| 390 | 50 | 50 | 0 | 0.8 | 1.5 |
| 391 | 45 | 45 | 0 | 1.1 | 2.0 |
| 392 | 45 | 45 | 0 | 0.4 | 0.75 |
| 393 | 45 | 45 | 0 | 1.1 | 1.5 |
| 394 | 45 | 45 | 0 | 1.5 | 1.5 |
| 395 | 45 | 45 | 0 | 1.3 | 1.25 |
| 396 | 45 | 45 | 0 | 1.3 | 1.0 |
| 397 | 45 | 45 | 0 | 0 | 0.5 |
| 398 | 0 | 0 | 0 | 0 | 1.75 |
| 399 | 0 | 0 | 0 | 1.1 | 1.25 |
| 400 | 45 | 45 | 0 | 0.8 | 1.5 |
| 401 | 45 | 45 | 0 | 1.1 | 0.75 |
| 402 | 55 | 45 | 10 | 0.4 | 1.5 |
| 403 | 50 | 50 | 0 | 0.8 | 0 |
| 404 | 50 | 50 | 0 | 0.8 | 1.0 |
| 405 | 50 | 50 | 0 | 1.1 | 0.5 |
| 406 | 45 | 45 | 0 | 1.3 | 1.25 |
| 407 | 45 | 45 | 0 | 0.4 | 1.0 |
| 408 | 45 | 45 | 0 | 0 | 0 |
| 409 | 0 | 0 | 0 | 0.4 | 0.25 |
| 410 | 45 | 45 | 0 | 0.4 | 1.0 |
| 411 | 45 | 45 | 0 | 0 | 1.0 |
| 412 | 0 | 0 | 0 | 0 | 0.25 |
| 413 | 0 | 0 | 0 | 0 | 1.0 |
| 414 | 55 | 45 | 10 | 0.4 | 0.75 |
| 415 | 45 | 45 | 0 | 0.8 | 0.25 |
| 416 | 55 | 45 | 10 | 1.3 | 2.0 |
| 417 | 55 | 45 | 10 | 0.8 | 0.25 |
| 418 | 55 | 45 | 10 | 0.8 | 1.0 |
| 419 | 50 | 50 | 0 | 0.4 | 0.25 |
| 420 | 45 | 45 | 0 | 0.4 | 1.5 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 421 | 45 | 45 | 0 | 0.4 | 1.25 |
| 422 | 0 | 0 | 0 | 0 | 0 |
| 423 | 0 | 0 | 0 | 0 | 0 |
| 424 | 45 | 45 | 0 | 0.4 | 0 |
| 425 | 45 | 45 | 0 | 0.4 | 0.5 |
| 426 | 45 | 45 | 0 | 0.4 | 1.5 |
| 427 | 45 | 45 | 0 | 0.4 | 1.0 |
| 428 | 0 | 0 | 0 | 0 | 1.0 |
| 429 | 45 | 45 | 0 | 0.4 | 1.5 |
| 430 | 45 | 45 | 0 | 1.1 | 0.5 |
| 431 | 45 | 45 | 0 | 0.6 | 0.5 |
| 432 | 45 | 45 | 0 | 1.5 | 0.75 |
| 433 | 45 | 45 | 0 | 0.4 | 0 |
| 434 | 45 | 45 | 0 | 0.4 | 1.25 |
| 435 | 50 | 50 | 0 | 0 | 0 |
| 436 | 45 | 45 | 0 | 0.6 | 0 |
| 437 | 0 | 0 | 0 | 0 | 1.5 |
| 438 | 0 | 0 | 0 | 0 | 2.0 |
| 439 | 0 | 0 | 0 | 0 | 2.0 |
| 440 | 0 | 0 | 0 | 0 | 1.25 |
| 441 | 45 | 45 | 0 | 0.4 | 0.75 |
| 442 | 45 | 45 | 0 | 0.6 | 0.25 |
| 443 | 0 | 0 | 0 | 0 | 0.5 |
| 444 | 0 | 0 | 0 | 0 | 1.0 |
| 445 | 0 | 0 | 0 | 0 | 0 |
| 446 | 45 | 45 | 0 | 0.4 | 1.0 |
| 447 | 45 | 45 | 0 | 0.4 | 0.5 |
| 448 | 0 | 0 | 0 | 0 | 2.0 |
| 449 | 45 | 45 | 0 | 0.4 | 0.5 |
| 450 | 45 | 45 | 0 | 0.4 | 2.0 |
| 451 | 45 | 45 | 0 | 1.1 | 1.25 |
| 452 | 45 | 45 | 0 | 0.6 | 0.75 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 453 | 45 | 45 | 0 | 0.4 | 0 |
| 454 | 45 | 45 | 0 | 0.4 | 1.0 |
| 455 | 45 | 45 | 0 | 0.4 | 0.5 |
| 456 | 45 | 45 | 0 | 0.4 | 0.5 |
| 457 | 0 | 0 | 0 | 0 | 0.75 |
| 458 | 45 | 45 | 0 | 0.4 | 2.0 |
| 459 | 45 | 45 | 0 | 1.3 | 1.0 |
| 460 | 45 | 45 | 0 | 1.7 | 0 |
| 461 | 45 | 45 | 0 | 0.4 | 0.5 |
| 462 | 0 | 0 | 0 | 0 | 1.0 |
| 463 | 45 | 45 | 0 | 0.6 | 1.0 |
| 464 | 45 | 45 | 0 | 1.3 | 1.25 |
| 465 | 45 | 45 | 0 | 1.3 | 0.5 |
| 466 | 45 | 45 | 0 | 0.8 | 2.0 |
| 467 | 45 | 45 | 0 | 0.4 | 1.25 |
| 468 | 45 | 45 | 0 | 0.8 | 1.5 |
| 469 | 45 | 45 | 0 | 0.8 | 1.25 |
| 470 | 50 | 50 | 0 | 0.8 | 1.0 |
| 471 | 50 | 50 | 0 | 0.8 | 0.5 |
| 472 | 50 | 50 | 0 | 1.3 | 0.5 |
| 473 | 50 | 50 | 0 | 0.8 | 1.0 |
| 474 | 45 | 45 | 0 | 0.8 | 1.0 |
| 475 | 45 | 45 | 0 | 1.1 | 1.0 |
| 476 | 45 | 45 | 0 | 1.3 | 1.25 |
| 477 | 45 | 45 | 0 | 1.9 | 2.0 |
| 478 | 45 | 45 | 0 | 0.8 | 1.0 |
| 479 | 0 | 0 | 0 | 0 | 1.0 |
| 480 | 45 | 45 | 0 | 1.3 | 1.5 |
| 481 | 45 | 45 | 0 | 1.3 | 0.5 |
| 482 | 45 | 45 | 0 | 0.4 | 2.0 |
| 483 | 45 | 45 | 0 | 0.4 | 0.75 |
| 484 | 45 | 45 | 0 | 0.8 | 0 |

| Grid No. | Height in meter | | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| | Maximum | Minimum | | | |
| 485 | 45 | 45 | 0 | 0.8 | 1.0 |
| 486 | 55 | 45 | 10 | 1.7 | 1.5 |
| 487 | 55 | 45 | 10 | 1.5 | 3.0 |
| 488 | 50 | 50 | 0 | 2.1 | 2.0 |
| 489 | 55 | 45 | 10 | 1.3 | 1.5 |
| 490 | 45 | 45 | 0 | 1.3 | 2.0 |
| 491 | 45 | 45 | 0 | 1.9 | 2.0 |
| 492 | 55 | 45 | 10 | 0.8 | 1.0 |
| 493 | 60 | 45 | 15 | 1.7 | 1.5 |
| 494 | 45 | 45 | 0 | 0.4 | 1.5 |
| 495 | 45 | 45 | 0 | 0.4 | 1.5 |
| 496 | 0 | 0 | 0 | 0 | 1.75 |
| 497 | 45 | 45 | 0 | 0.4 | 1.5 |
| 498 | 45 | 45 | 0 | 1.3 | .5 |
| 499 | 45 | 45 | 0 | 0.4 | 1.75 |
| 500 | 45 | 45 | 0 | 0.4 | .75 |
| 501 | 45 | 45 | 0 | 0.8 | 0 |
| 502 | 45 | 45 | 0 | 0.4 | 1.25 |
| 503 | 55 | 45 | 10 | 1.1 | 1.0 |
| 504 | 55 | 45 | 10 | 1.5 | 3.0 |
| 505 | 55 | 45 | 10 | 1.9 | 3.0 |
| 506 | 45 | 45 | 0 | 1.1 | 2.0 |
| 507 | 45 | 45 | 0 | 1.1 | 1.0 |
| 508 | 45 | 45 | 0 | 1.7 | 1.0 |
| 509 | 45 | 45 | 0 | 1.5 | 1.0 |
| 510 | 55 | 45 | 10 | 3.0 | 2.0 |
| 511 | 55 | 45 | 10 | 1.5 | 2.0 |
| 512 | 45 | 45 | 0 | 1.3 | 1.0 |
| 513 | 45 | 45 | 0 | 0.6 | 2.0 |
| 514 | 0 | 0 | 0 | 0 | 1.0 |
| 515 | 0 | 0 | 0 | 0 | 1.0 |
| 516 | 45 | 45 | 0 | 1.1 | 0 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 517 | 45 | 45 | 0 | 0.4 | 2.5 |
| 518 | 45 | 45 | 0 | 1.3 | 1.5 |
| 519 | 55 | 45 | 10 | 0.8 | .5 |
| 520 | 45 | 45 | 0 | 0.4 | .5 |
| 521 | 45 | 45 | 0 | 0.8 | 1.5 |
| 522 | 45 | 45 | 0 | 1.5 | 3.0 |
| 523 | 45 | 45 | 0 | 1.3 | 2.5 |
| 524 | 45 | 45 | 0 | 0.8 | 1.0 |
| 525 | 45 | 45 | 0 | 0.4 | 1.0 |
| 526 | 55 | 45 | 10 | 0.8 | 0 |
| 527 | 45 | 45 | 0 | 1.3 | 0 |
| 528 | 45 | 45 | 0 | 1.7 | 0 |
| 529 | 45 | 45 | 0 | 1.5 | 0 |
| 530 | 55 | 45 | 10 | 1.1 | 0 |
| 531 | 0 | 0 | 0 | 0 | 0 |
| 532 | 0 | 0 | 0 | 0 | 1.0 |
| 533 | 0 | 0 | 0 | 0 | 1.0 |
| 534 | 45 | 45 | 0 | 0.8 | 1.0 |
| 535 | 0 | 0 | 0 | 0 | 2.0 |
| 536 | 45 | 45 | 0 | 1.1 | .5 |
| 537 | 45 | 45 | 0 | 0.8 | .5 |
| 538 | 45 | 45 | 0 | 1.1 | .5 |
| 539 | 45 | 45 | 0 | 0.4 | 3.0 |
| 540 | 45 | 45 | 0 | 0.4 | 1.5 |
| 541 | 45 | 45 | 0 | 0.6 | 2.0 |
| 542 | 45 | 45 | 0 | 0.6 | .5 |
| 543 | 45 | 45 | 0 | 1.1 | 1.25 |
| 544 | 45 | 45 | 0 | 0.8 | 1.5 |
| 545 | 55 | 45 | 10 | 1.5 | 1.0 |
| 546 | 45 | 45 | 0 | 1.3 | 0 |
| 547 | 45 | 45 | 0 | 1.1 | 0 |
| 548 | 45 | 45 | 0 | 1.5 | 0 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 549 | 45 | 45 | 0 | 0.4 | 0 |
| 550 | 0 | 0 | 0 | 0 | 1.0 |
| 551 | 0 | 0 | 0 | 0 | 1.0 |
| 552 | 45 | 45 | 0 | 0.4 | .5 |
| 553 | 45 | 45 | 0 | 0.8 | 1.0 |
| 554 | 50 | 40 | 10 | 1.9 | 1.25 |
| 555 | 45 | 45 | 0 | 0.4 | 1.25 |
| 556 | 45 | 45 | 0 | 1.1 | 1.5 |
| 557 | 45 | 45 | 0 | 1.1 | 1.0 |
| 558 | 45 | 45 | 0 | 0.4 | 1.5 |
| 559 | 0 | 0 | 0 | 0 | 2.5 |
| 560 | 45 | 45 | 0 | 0.4 | .5 |
| 561 | 45 | 45 | 0 | 0.6 | 1.25 |
| 562 | 45 | 45 | 0 | 0.8 | 0 |
| 563 | 45 | 45 | 0 | 1.1 | 1.5 |
| 564 | 50 | 45 | 5 | 0.8 | 0 |
| 565 | 50 | 45 | 5 | 0.8 | 0 |
| 566 | 45 | 45 | 0 | 1.5 | 0 |
| 567 | 0 | 0 | 0 | 0 | 0 |
| 568 | 45 | 45 | 0 | 0.4 | .5 |
| 569 | 40 | 40 | 0 | 0.4 | 1.0 |
| 570 | 0 | 0 | 0 | 0 | 1.0 |
| 571 | 0 | 0 | 0 | 0 | 0 |
| 572 | 40 | 40 | 0 | 2.1 | 2.0 |
| 573 | 40 | 40 | 0 | 1.9 | 1.25 |
| 574 | 40 | 40 | 0 | 2.6 | 1.5 |
| 575 | 45 | 40 | 5 | 1.5 | 2.5 |
| 576 | 45 | 45 | 0 | 0.6 | .5 |
| 577 | 45 | 45 | 0 | 0.4 | 0 |
| 578 | 0 | 0 | 0 | 0 | 1.0 |
| 579 | 0 | 0 | 0 | 0 | 1.5 |
| 580 | 45 | 45 | 0 | 0.4 | 0 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 581 | 0 | 0 | 0 | 0 | 1.5 |
| 582 | 45 | 45 | 0 | 0.4 | 0 |
| 583 | 45 | 45 | 0 | 0.8 | 0 |
| 584 | 45 | 45 | 0 | 0.8 | 0 |
| 585 | 0 | 0 | 0 | 0 | .5 |
| 586 | 40 | 40 | 0 | 0.8 | 1.0 |
| 587 | 40 | 40 | 0 | 1.1 | .5 |
| 588 | 40 | 40 | 0 | 1.5 | 1.0 |
| 589 | 40 | 40 | 0 | 1.3 | 0 |
| 590 | 40 | 40 | 0 | 1.9 | 0 |
| 591 | 40 | 40 | 0 | 1.1 | 1.0 |
| 592 | 40 | 40 | 0 | 0.8 | 2.5 |
| 593 | 45 | 40 | 5 | 1.3 | 2.0 |
| 594 | 45 | 45 | 0 | 0.4 | .5 |
| 595 | 45 | 45 | 0 | 0.8 | 0 |
| 596 | 45 | 45 | 0 | 0.6 | 0 |
| 597 | 0 | 0 | 0 | 0 | .5 |
| 598 | 40 | 40 | 0 | 0.8 | 1.5 |
| 599 | 40 | 40 | 0 | 0.4 | .5 |
| 600 | 45 | 45 | 0 | 0.8 | 0 |
| 601 | 45 | 45 | 0 | 0.4 | 0 |
| 602 | 0 | 0 | 0 | 0 | 0 |
| 603 | 0 | 0 | 0 | 0 | 0 |
| 604 | 45 | 45 | 0 | 0.4 | 1.0 |
| 605 | 40 | 40 | 0 | 1.7 | 1.25 |
| 606 | 45 | 45 | 0 | 0.4 | 1.0 |
| 607 | 45 | 45 | 0 | 1.5 | 1.0 |
| 608 | 40 | 40 | 0 | 1.3 | .25 |
| 609 | 0 | 0 | 0 | 0.4 | .25 |
| 610 | 40 | 40 | 0 | 0 | 3.0 |
| 611 | 45 | 45 | 0 | 1.7 | 2.0 |
| 612 | 45 | 40 | 5 | 1.3 | 2.25 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 613 | 45 | 45 | 0 | 1.1 | .25 |
| 614 | 45 | 45 | 0 | 0.4 | 0 |
| 615 | 0 | 0 | 0 | 0 | 0 |
| 616 | 45 | 45 | 0 | 1.3 | 1.0 |
| 617 | 40 | 40 | 0 | 0.4 | 0 |
| 618 | 45 | 45 | 0 | 0.8 | 0 |
| 619 | 45 | 45 | 0 | 0.4 | 0 |
| 620 | 0 | 0 | 0 | 0 | 0 |
| 621 | 0 | 0 | 0 | 0 | 0 |
| 622 | 0 | 0 | 0 | 0 | 0 |
| 623 | 40 | 40 | 0 | 0.4 | .15 |
| 624 | 40 | 40 | 0 | 0.4 | 3.0 |
| 625 | 0 | 0 | 0 | 0 | 1.0 |
| 626 | 0 | 0 | 0 | 0 | 1.25 |
| 627 | 40 | 40 | 0 | 0.4 | 1.0 |
| 628 | 40 | 40 | 0 | 0.4 | 1.0 |
| 629 | 0 | 0 | 0 | 0 | .25 |
| 630 | 0 | 0 | 0 | 0 | 1.50 |
| 631 | 40 | 40 | 0 | 0.4 | .75 |
| 632 | 45 | 40 | 50 | 1.5 | 1.5 |
| 633 | 0 | 0 | 0 | 0 | 0 |
| 634 | 40 | 40 | 0 | 0.4 | 1.0 |
| 635 | 40 | 40 | 0 | 0.8 | 2.0 |
| 636 | 40 | 40 | 0 | 0.8 | 1.0 |
| 637 | 40 | 40 | 0 | 0.4 | 0 |
| 638 | 40 | 40 | 0 | 1.1 | 0 |
| 639 | 40 | 40 | 0 | 1.1 | 0 |
| 640 | 0 | 0 | 0 | 0 | 0 |
| 641 | 0 | 0 | 0 | 0 | 0 |
| 642 | 40 | 40 | 0 | 0.4 | .5 |
| 643 | 40 | 40 | 0 | 1.3 | .5 |
| 644 | 0 | 0 | 0 | 0 | 1.5 |
| 645 | 40 | 40 | 0 | 0.4 | 1.0 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 646 | 0 | 0 | 0 | 0 | 1.25 |
| 647 | 45 | 45 | 0 | 0.4 | 2.5 |
| 648 | 45 | 40 | 5 | 1.9 | 1.0 |
| 649 | 0 | 0 | 0 | 0 | 0 |
| 650 | 40 | 40 | 0 | 0.8 | 0 |
| 651 | 40 | 40 | 0 | 0.4 | 1.0 |
| 652 | 40 | 40 | 0 | 0.4 | .5 |
| 653 | 40 | 40 | 0 | 0.8 | 0 |
| 654 | 40 | 40 | 0 | 0.4 | .5 |
| 655 | 40 | 40 | 0 | 0.4 | .5 |
| 656 | 0 | 0 | 0 | 0 | 0 |
| 657 | 0 | 0 | 0 | 0 | 0 |
| 658 | 40 | 40 | 0 | 0.4 | .5 |
| 659 | 40 | 40 | 0 | 1.1 | 1.0 |
| 660 | 0 | 0 | 0 | 0 | 1.0 |
| 661 | 0 | 0 | 0 | 0 | 1.0 |
| 662 | 0 | 0 | 0 | 0 | .5 |
| 663 | 40 | 40 | 0 | 0.4 | 1.5 |
| 664 | 40 | 40 | 0 | 1.9 | 0 |
| 665 | 0 | 0 | 0 | 0 | 0 |
| 666 | 40 | 40 | 0 | 1.1 | 0 |
| 667 | 40 | 40 | 0 | 0.6 | .5 |
| 668 | 0 | 0 | 0 | 0 | 1.5 |
| 669 | 40 | 40 | 0 | 0.4 | .5 |
| 670 | 0 | 0 | 0 | 0 | 2.0 |
| 671 | 40 | 40 | 0 | 0.4 | 0 |
| 672 | 0 | 0 | 0 | 0 | 0 |
| 673 | 80 | 0 | 80 | 0 | 0 |
| 674 | 0 | 0 | 0 | 0 | 0 |
| 675 | 40 | 40 | 0 | 0.4 | 0 |
| 676 | 40 | 40 | 0 | 0.6 | 0 |
| 677 | 0 | 0 | 0 | 0 | 1.0 |
| 678 | 0 | 0 | 0 | 0 | 1.0 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 679 | 40 | 40 | 0 | 1.3 | .5 |
| 680 | 40 | 40 | 0 | 0.4 | .25 |
| 681 | 0 | 0 | 0 | 0 | 0 |
| 682 | 40 | 40 | 0 | 0.4 | 0 |
| 683 | 40 | 40 | 0 | 0.4 | 1.5 |
| 684 | 0 | 0 | 0 | 0 | .25 |
| 685 | 0 | 0 | 0 | 0 | 2.0 |
| 686 | 40 | 40 | 0 | 0.4 | 0 |
| 687 | 0 | 0 | 0 | 0 | 0 |
| 688 | 0 | 0 | 0 | 0 | 0 |
| 689 | 0 | 0 | 0 | 0 | 0 |
| 690 | 0 | 0 | 0 | 0 | 0 |
| 691 | 40 | 40 | 0 | 0.4 | 0 |
| 692 | 0 | 0 | 0 | 0 | .25 |
| 693 | 0 | 0 | 0 | 0 | 1.0 |
| 694 | 0 | 0 | 0 | 0 | 1.5 |
| 695 | 0 | 0 | 0 | 0 | 2.0 |
| 696 | 40 | 40 | 0 | 0.4 | 1.0 |
| 697 | 0 | 0 | 0 | 0 | 0 |
| 698 | 40 | 40 | 0 | 0.8 | 0 |
| 699 | 40 | 40 | 0 | 0.4 | .5 |
| 700 | 0 | 0 | 0 | 0 | 2.0 |
| 701 | 40 | 40 | 0 | 0.4 | 0 |
| 702 | 40 | 40 | 0 | 0.8 | 0 |
| 703 | 0 | 0 | 0 | 0 | 0 |
| 704 | 0 | 0 | 0 | 0 | 0 |
| 705 | 0 | 0 | 0 | 0 | 0 |
| 706 | 40 | 40 | 0 | 0.4 | 0 |
| 707 | 40 | 40 | 0 | 0.8 | .25 |
| 708 | 0 | 0 | 0 | 0 | .25 |
| 709 | 0 | 0 | 0 | 0 | .5 |
| 710 | 0 | 0 | 0 | 0 | 1.0 |
| 711 | 0 | 0 | 0 | 0 | .5 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 712 | 40 | 40 | 0 | 0.4 | .5 |
| 713 | 35 | 35 | 0 | 0.8 | 0 |
| 714 | 35 | 35 | 0 | 0.4 | 0 |
| 715 | 35 | 35 | 0 | 1.7 | .5 |
| 716 | 40 | 40 | 0 | 0.8 | 1.0 |
| 717 | 40 | 40 | 0 | 0.4 | 2.5 |
| 718 | 40 | 40 | 0 | 0.4 | 0 |
| 719 | 40 | 40 | 0 | 0.8 | 0 |
| 720 | 0 | 0 | 0 | 0 | 0 |
| 721 | 0 | 0 | 0 | 0 | 0 |
| 722 | 0 | 0 | 0 | 0 | 0 |
| 723 | 40 | 40 | 0 | 0.4 | 0 |
| 724 | 40 | 40 | 0 | 0.4 | .75 |
| 725 | 0 | 0 | 0 | 0 | 1.5 |
| 726 | 0 | 0 | 0 | 0 | .5 |
| 727 | 0 | 0 | 0 | 0 | .25 |
| 728 | 0 | 0 | 0 | 0 | 1.0 |
| 729 | 0 | 0 | 0 | 0 | 2.75 |
| 730 | 40 | 40 | 0 | 0.4 | 2.5 |
| 731 | 40 | 40 | 0 | 1.3 | .50 |
| 732 | 40 | 40 | 0 | 0.4 | .75 |
| 733 | 40 | 40 | 0 | 0.4 | 0 |
| 734 | 40 | 40 | 0 | 0.4 | 1.3 |
| 735 | 40 | 40 | 0 | 1.3 | 2.0 |
| 736 | 40 | 40 | 0 | 0.8 | 1.0 |
| 737 | 40 | 40 | 0 | 0.4 | 0 |
| 738 | 0 | 0 | 0 | 0 | 0 |
| 739 | 0 | 0 | 0 | 0 | 0 |
| 740 | 0 | 0 | 0 | 0 | 0 |
| 741 | 40 | 40 | 0 | 0.4 | 0 |
| 742 | 0 | 0 | 0 | 0 | .5 |
| 743 | 0 | 0 | 0 | 0 | 1.25 |
| 744 | 0 | 0 | 0 | 0 | 1.0 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq. mile) |
|---|---|---|---|---|---|
| 745 | 0 | 0 | 0 | 0 | 0 |
| 746 | 0 | 0 | 0 | 0 | 1.0 |
| 747 | 0 | 0 | 0 | 0 | 1.0 |
| 748 | 0 | 0 | 0 | 0 | 0 |
| 749 | 0 | 0 | 0 | 0 | 1.0 |
| 750 | 40 | 40 | 0 | 0.4 | 1.0 |
| 751 | 40 | 40 | 0 | 1.3 | .25 |
| 752 | 40 | 40 | 0 | 0.4 | .25 |
| 753 | 0 | 0 | 0 | 0 | 0 |
| 754 | 0 | 0 | 0 | 0 | 1.5 |
| 755 | 40 | 40 | 0 | 1.3 | 4.0 |
| 756 | 40 | 40 | 0 | 0.8 | 1.0 |
| 757 | 40 | 40 | 0 | 0.4 | - |
| 758 | 0 | 0 | 0 | 0 | - |
| 759 | 40 | 40 | 0 | 0.4 | 1.0 |
| 760 | 0 | 0 | 0 | 0 | 1.5 |
| 761 | 40 | 40 | 0 | 1.1 | - |
| 762 | 40 | 40 | 0 | 0.8 | 0 |
| 763 | 0 | 0 | 0 | 0 | 0 |
| 764 | 0 | 0 | 0 | 0 | .25 |
| 765 | 40 | 40 | 0 | 0.4 | 1.5 |
| 766 | 0 | 0 | 0 | 0 | - |
| 767 | 0 | 0 | 0 | 0 | - |
| 768 | 0 | 0 | 0 | 0 | .75 |
| 769 | 0 | 0 | 0 | 0 | 1.0 |
| 770 | 0 | 0 | 0 | 0 | - |
| 771 | 40 | 40 | 0 | 0.8 | 1.25 |
| 772 | 40 | 40 | 0 | 1.7 | .5 |
| 773 | 45 | 40 | 5 | 1.5 | 1.5 |
| 774 | 40 | 40 | 0 | 1.3 | 1.75 |
| 775 | 40 | 40 | 0 | 1.5 | 1.0 |
| 776 | 40 | 40 | 0 | 0.4 | 0 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq. mile) |
|---|---|---|---|---|---|
| 777 | 40 | 40 | 0 | 0.8 | 0 |
| 778 | 40 | 40 | 0 | 0.4 | .75 |
| 779 | 40 | 40 | 0 | 1.3 | 2.0 |
| 780 | 40 | 40 | 0 | 0 | 1.75 |
| 781 | 40 | 40 | 0 | 0.6 | 0 |
| 782 | 40 | 40 | 0 | 0.8 | 1.0 |
| 783 | 0 | 0 | 0 | 0 | .75 |
| 784 | 0 | 0 | 0 | 0 | 0 |
| 785 | 40 | 40 | 0 | 0.8 | .20 |
| 786 | 40 | 40 | 0 | 0.8 | 2.5 |
| 787 | 40 | 40 | 0 | 1.7 | 1.25 |
| 788 | 40 | 40 | 0 | 0.4 | 1.0 |
| 789 | 40 | 40 | 0 | 0.4 | 0 |
| 790 | 0 | 0 | 0 | 0 | 1.75 |
| 791 | 0 | 0 | 0 | 0 | 0 |
| 792 | 40 | 40 | 0 | 0.4 | 1.25 |
| 793 | 40 | 40 | 0 | 1.3 | 1.5 |
| 794 | 0 | 0 | 0 | 0 | 1.25 |
| 795 | 40 | 40 | 0 | 0.4 | .25 |
| 796 | 40 | 40 | 0 | 0.8 | 1.25 |
| 797 | 40 | 40 | 0 | 0.8 | .75 |
| 798 | 40 | 40 | 0 | 0.4 | 0 |
| 799 | 0 | 0 | 0 | 0 | 1.0 |
| 800 | 45 | 35 | 10 | 0.8 | 2.5 |
| 801 | 0 | 0 | 0 | 0 | 1.25 |
| 802 | 45 | 40 | 5 | 0.4 | 0 |
| 803 | 0 | 0 | 0 | 0 | 0 |
| 804 | 0 | 0 | 0 | 0 | 1.0 |
| 805 | 0 | 0 | 0 | 0 | 0 |
| 806 | 0 | 0 | 0 | 0 | 0 |
| 807 | 40 | 40 | 0 | 0.8 | 1.5 |
| 808 | 40 | 40 | 0 | 2.1 | 4.5 |
| 809 | 40 | 40 | 0 | 1.5 | 1.20 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density ( per sq.mile) |
|---|---|---|---|---|---|
| 810 | 40 | 40 | 0 | 0.6 | 2.0 |
| 811 | 0 | 0 | 0 | 0 | 1.5 |
| 812 | 0 | 0 | 0 | 0 | 2.75 |
| 813 | 40 | 40 | 0 | 0.4 | 2.5 |
| 814 | 40 | 40 | 0 | 0.4 | 1.75 |
| 815 | 40 | 40 | 0 | 0.8 | 1.5 |
| 816 | 40 | 40 | 0 | 0.6 | 1.75 |
| 817 | 40 | 40 | 0 | 0.4 | 3.0 |
| 818 | 40 | 40 | 0 | 1.1 | 3.25 |
| 819 | 0 | 0 | 0 | 0 | 1.0 |
| 820 | 45 | 45 | 0 | 0.8 | 1.75 |
| 821 | 45 | 45 | 0 | 0.8 | 1.5 |
| 822 | 35 | 34 | 0 | 0.6 | 0 |
| 823 | 35 | 35 | 0 | 0.8 | 1.75 |
| 824 | 0 | 0 | 0 | 0 | .75 |
| 825 | 0 | 0 | 0 | 0 | 1.25 |
| 826 | 0 | 0 | 0 | 0 | 0 |
| 827 | 0 | 0 | 0 | 0 | 0 |
| 828 | 0 | 0 | 0 | 0 | 0 |
| 829 | 40 | 40 | 0 | 0.4 | 0 |
| 830 | 0 | 0 | 0 | 0 | 0 |
| 831 | 40 | 40 | 0 | 0.4 | 0 |
| 832 | 40 | 40 | 0 | 0.4 | 1.0 |
| 833 | 40 | 40 | 0 | 0.6 | 1.5 |
| 834 | 40 | 40 | 0 | 0.8 | 2.25 |
| 835 | 40 | 40 | 0 | 0.4 | 3.0 |
| 836 | 40 | 40 | 0 | 0.4 | 3.25 |
| 837 | 0 | 0 | 0 | 0 | 2.25 |
| 838 | 40 | 40 | 0 | 0.4 | 2.5 |
| 839 | 45 | 40 | 5 | 1.3 | 3.25 |
| 840 | 35 | 35 | 0 | 0.8 | 1.75 |
| 841 | 35 | 35 | 0 | 1.3 | .5 |
| 842 | 35 | 35 | 0 | 0.8 | 0 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 843 | 0 | 0 | 0 | 0 | 1.25 |
| 844 | 35 | 35 | 0 | 0.4 | .75 |
| 845 | 0 | 0 | 0 | 0 | .5 |
| 846 | 0 | 0 | 0 | 0 | 1.25 |
| 847 | 0 | 0 | 0 | 0 | 1.0 |
| 848 | 0 | 0 | 0 | 0 | 0 |
| 849 | 0 | 0 | 0 | 0 | 0 |
| 850 | 0 | 0 | 0 | 0 | 0 |
| 851 | 0 | 0 | 0 | 0 | .25 |
| 852 | 40 | 40 | 0 | 0.4 | 1.0 |
| 853 | 40 | 40 | 0 | 0.8 | 1.25 |
| 854 | 0 | 0 | 0 | 0 | 1.75 |
| 856 | 40 | 40 | 0 | 1.3 | 1.0 |
| 856 | 40 | 40 | 0 | 0.6 | 4.0 |
| 857 | 40 | 40 | 0 | 0.4 | 2.0 |
| 858 | 40 | 40 | 0 | 0.4 | 0 |
| 859 | 40 | 40 | 0 | 0.4 | 1.75 |
| 860 | 40 | 40 | 0 | 0.4 | 2.5 |
| 861 | 35 | 35 | 0 | 0.4 | 3.0 |
| 862 | 0 | 0 | 0 | 0 | 1.5 |
| 863 | 35 | 35 | 0 | 1.5 | 1.5 |
| 864 | 35 | 35 | 0 | 1.3 | .65 |
| 865 | 35 | 35 | 0 | 0.4 | .5 |
| 866 | 35 | 35 | 0 | 0.8 | 1.1 |
| 867 | 0 | 0 | | 0 | .75 |
| 868 | 40 | 40 | 0 | 0.8 | 1.5 |
| 869 | 40 | 40 | 0 | 0.4 | 0.5 |
| 870 | 0 | 0 | 0 | 0 | 0 |
| 871 | 0 | 0 | 0 | 0 | 0 |
| 872 | 0 | 0 | 0 | 0 | 0 |
| 873 | 0 | 0 | 0 | 0 | 0 |
| 874 | 0 | 0 | 0 | 0 | 0 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 875 | 40 | 40 | 0 | 0.4 | 0.65 |
| 876 | 0 | 0 | 0 | 0 | 0.2 |
| 877 | 0 | 0 | 0 | 0 | 1.25 |
| 878 | 40 | 40 | 0 | 0.6 | 2.25 |
| 879 | 0 | 0 | 0 | 0 | .65 |
| 880 | 40 | 40 | 0 | 0.8 | 1.0 |
| 881 | 40 | 40 | 0 | 0.8 | 0 |
| 882 | 0 | 0 | 0 | 0 | 1.0 |
| 883 | 40 | 40 | 0 | 0.4 | 0.5 |
| 884 | 0 | 0 | 0 | 0 | 0.5 |
| 885 | 35 | 35 | 0 | 0.8 | 1.5 |
| 886 | 35 | 35 | 0 | 0.4 | 0 |
| 887 | 35 | 35 | 0 | 1.1 | 0.2 |
| 888 | 35 | 35 | 0 | 0.4 | 0 |
| 889 | 35 | 35 | 0 | 0.4 | 0 |
| 890 | 35 | 35 | 0 | 0.4 | 0 |
| 891 | 0 | 0 | 0 | 0 | 0 |
| 892 | 40 | 40 | 0 | 0.8 | 1.1 |
| 893 | 40 | 40 | 0 | 0.4 | .80 |
| 894 | 0 | 0 | 0 | 0 | 0 |
| 895 | 0 | 0 | 0 | 0 | 0 |
| 896 | 0 | 0 | 0 | 0 | 0 |
| 897 | 0 | 0 | 0 | 0 | 0 |
| 898 | 40 | 40 | 0 | 0.4 | 0 |
| 899 | 40 | 40 | 0 | 0.4 | 1.1 |
| 900 | 0 | 0 | 0 | 0 | 0 |
| 901 | 0 | 0 | 0 | 0 | 0 |
| 902 | 0 | 0 | 0 | 0 | 1.2 |
| 903 | 0 | 0 | 0 | 0 | 1.0 |
| 904 | 0 | 0 | 0 | 0 | 1.0 |
| 905 | 0 | 0 | 0 | 0 | 1.0 |
| 906 | 40 | 40 | 0 | 0.4 | 0 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 907 | 40 | 40 | 0 | 0.8 | 1.2 |
| 908 | 0 | 0 | 0 | 0 | 1.5 |
| 909 | 40 | 40 | 0 | 1.5 | 2.95 |
| 910 | 40 | 40 | 0 | 0.4 | 1.1 |
| 911 | 35 | 35 | 0 | 0.8 | 0.5 |
| 912 | 35 | 35 | 0 | 0.6 | 2.0 |
| 913 | 35 | 35 | 0 | 1.3 | 2.01 |
| 914 | 35 | 35 | 0 | 1.3 | 0.4 |
| 915 | 35 | 35 | 0 | 0.4 | 0 |
| 916 | 0 | 0 | 0 | 0 | 0 |
| 917 | 40 | 40 | 0 | 0.4 | 0 |
| 918 | 40 | 40 | 0 | 0.8 | 2.0 |
| 919 | 40 | 40 | 0 | 0.4 | 0 |
| 920 | 0 | 0 | 0 | 0 | 0 |
| 921 | 0 | 0 | 0 | 0 | 0 |
| 922 | 0 | 0 | 0 | 0 | .75 |
| 923 | 40 | 40 | 0 | 0.4 | 0 |
| 924 | 40 | 40 | 0 | 0.4 | 0 |
| 925 | 0 | 0 | 0 | 0 | .5 |
| 926 | 0 | 0 | 0 | 0 | .5 |
| 927 | 0 | 0 | 0 | 0 | 1.0 |
| 928 | 0 | 0 | 0 | 0 | 0 |
| 929 | 0 | 0 | 0 | 0 | 1.25 |
| 930 | 0 | 0 | 0 | 0 | 1.0 |
| 931 | 0 | 0 | 0 | 0 | 1.25 |
| 932 | 40 | 40 | 0 | 0.4 | 0 |
| 933 | 0 | 0 | 0 | 0 | 0 |
| 934 | 0 | 0 | 0 | 0 | 1.0 |
| 935 | 40 | 40 | 0 | 1.1 | 2.0 |
| 936 | 40 | 40 | 0 | 0.4 | 2.0 |
| 937 | 35 | 15 | 0 | 0.4 | .75 |
| 938 | 40 | 40 | 0 | 0.4 | 3.0 |
| 939 | 35 | 35 | 0 | 0.4 | 1.25 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 940 | 35 | 35 | 0 | 0.4 | 1.0 |
| 941 | 0 | 0 | 0 | 0 | 0 |
| 942 | 0 | 0 | 0 | 0 | 0 |
| 943 | 40 | 40 | 0 | 0.4 | 0 |
| 944 | 40 | 40 | 0 | 0.4 | 2.0 |
| 945 | 0 | 0 | 0 | 0 | 0 |
| 946 | 0 | 0 | 0 | 0 | 0 |
| 947 | 40 | 40 | 10 | 0.4 | 0 |
| 948 | 40 | 40 | 10 | 0.8 | 2.5 |
| 949 | 40 | 40 | 10 | 0.4 | 0 |
| 950 | 0 | 0 | 0 | 0 | 0 |
| 951 | 0 | 0 | 0 | 0 | 0 |
| 952 | 0 | 0 | 0 | 0 | 1.0 |
| 953 | 0 | 0 | 0 | 0 | 1.75 |
| 954 | 0 | 0 | 0 | 0 | 0 |
| 955 | 0 | 0 | 0 | 0 | 1.25 |
| 956 | 0 | 0 | 0 | 0 | 0 |
| 957 | 40 | 40 | 0 | 0.4 | 1.5 |
| 958 | 0 | 0 | 0 | 0 | 1.25 |
| 959 | 0 | 0 | 0 | 0 | .50 |
| 960 | 0 | 0 | 0 | 0 | 0 |
| 961 | 0 | 0 | 0 | 0 | 0 |
| 962 | 0 | 0 | 0 | 0 | .50 |
| 963 | 0 | 0 | 0 | 0 | 2.5 |
| 964 | 40 | 40 | 0 | 0.4 | .75 |
| 965 | 40 | 40 | 0 | 0.4 | 1.0 |
| 966 | 40 | 40 | 0 | 0.8 | .25 |
| 967 | 40 | 40 | 0 | 0.4 | 3.0 |
| 968 | 40 | 40 | 0 | 0.4 | 1.0 |
| 969 | 40 | 40 | 0 | 0.4 | .25 |
| 970 | 40 | 40 | 0 | 0.4 | .50 |
| 971 | 40 | 40 | 0 | 0.6 | 0 |
| 972 | 40 | 40 | 0 | 1.5 | 2.5 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq. mile) |
|---|---|---|---|---|---|
| 973 | 40 | 40 | 0 | 0.6 | .25 |
| 974 | 0 | 0 | 0 | 0 | 0 |
| 975 | 40 | 40 | 0 | 0.6 | 0 |
| 976 | 40 | 40 | 0 | 1.3 | 1.25 |
| 977 | 40 | 40 | 0 | 0.6 | .65 |
| 978 | 0 | 0 | 0 | 0 | .25 |
| 979 | 0 | 0 | 0 | 0 | 0 |
| 980 | 0 | 0 | 0 | 0 | 0 |
| 981 | 0 | 0 | 0 | 0 | 1.0 |
| 982 | 0 | 0 | 0 | 0 | .25 |
| 983 | 0 | 0 | 0 | 0 | 1.0 |
| 984 | 0 | 0 | 0 | 0 | 1.0 |
| 985 | 0 | 0 | 0 | 0 | 1.25 |
| 986 | 0 | 0 | 0 | 0 | 0 |
| 987 | 0 | 0 | 0 | 0 | 0 |
| 988 | 40 | 40 | 0 | 0.4 | 0 |
| 989 | 0 | 0 | 0 | 0 | 1.75 |
| 990 | 0 | 0 | 0 | 0 | .75 |
| 991 | 0 | 0 | 0 | 0 | 0 |
| 992 | 0 | 0 | 0 | 0 | 0 |
| 993 | 0 | 0 | 0 | 0 | 0 |
| 994 | 0 | 0 | 0 | 0 | 0 |
| 995 | 0 | 0 | 0 | 0 | .50 |
| 996 | 40 | 40 | 0 | 0.4 | 2.0 |
| 997 | 40 | 40 | 0 | 0.4 | 2.0 |
| 998 | 0 | 0 | 0 | 0 | 1.5 |
| 999 | 40 | 40 | 0 | 0.6 | .25 |
| 1000 | 40 | 40 | 0 | 0.8 | 0 |
| 1 | 40 | 40 | 0 | 0.8 | 1.25 |
| 2 | 30 | 30 | 0 | 0.4 | 0 |
| 3 | 30 | 30 | 0 | 0.4 | 0 |
| 4 | 30 | 30 | 0 | 0.4 | 0 |
| 5 | 30 | 30 | 0 | 0.8 | 1.75 |

| Grid No. | Height in meter | | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| | Maximum | Minimum | | | |
| 6 | 30 | 30 | 0 | 0.4 | 0 |
| 7 | 30 | 30 | 0 | 0.4 | 0 |
| 8 | 30 | 30 | 0 | 0.4 | 0 |
| 9 | 0 | 0 | 0 | 0 | .25 |
| 10 | 0 | 0 | 0 | 0 | 1.25 |
| 11 | 0 | 0 | 0 | 0 | 1.75 |
| 12 | 0 | 0 | 0 | 0 | 0 |
| 13 | 0 | 0 | 0 | 0 | .50 |
| 14 | 0 | 0 | 0 | 0 | 1.50 |
| 15 | 0 | 0 | 0 | 0 | 1.0 |
| 16 | 0 | 0 | 0 | 0 | 0 |
| 17 | 0 | 0 | 0 | 0 | 0 |
| 18 | 0 | 0 | 0 | 0 | 0 |
| 19 | 0 | 0 | 0 | 0 | 0 |
| 20 | 0 | 0 | 0 | 0 | 0 |
| 21 | 0 | 0 | 0 | 0 | 0 |
| 22 | 0 | 0 | 0 | 0 | 0 |
| 23 | 0 | 0 | 0 | 0 | 1.0 |
| 24 | 0 | 0 | 0 | 0 | 1.0 |
| 25 | 0 | 0 | 0 | 0 | 0 |
| 26 | 0 | 0 | 0 | 0 | 0 |
| 27 | 0 | 0 | 0 | 0 | 0 |
| 28 | 30 | 30 | 0 | 0.8 | 0 |
| 29 | 30 | 30 | 0 | 2.6 | 1.25 |
| 30 | 30 | 30 | 0 | 1.3 | 2.0 |
| 31 | 0 | 0 | 0 | 0 | 0 |
| 32 | 30 | 30 | 0 | 0.4 | 0 |
| 33 | 30 | 30 | 0 | 0.4 | 0 |
| 34 | 30 | 30 | 0 | 0.4 | 1.25 |
| 35 | 30 | 30 | 0 | 0.4 | 0 |
| 36 | 30 | 30 | 0 | 0.4 | 0 |
| 37 | 0 | 0 | 0 | 0 | 0 |
| 38 | 0 | 0 | 0 | 0 | 1.25 |
| 39 | 0 | 0 | 0 | 0 | 0 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq. mile) |
|---|---|---|---|---|---|
| 1040 | 0 | 0 | 0 | 0 | 0 |
| 41 | 0 | 0 | 0 | 0 | 0 |
| 42 | 0 | 0 | 0 | 0 | 0 |
| 43 | 0 | 0 | 0 | 0 | 0 |
| 44 | 0 | 0 | 0 | 0 | .25 |
| 45 | 0 | 0 | 0 | 0 | .75 |
| 46 | 0 | 0 | 0 | 0 | 0 |
| 47 | 0 | 0 | 0 | 0 | 1.0 |
| 48 | 0 | 0 | 0 | 0 | 1.25 |
| 49 | 0 | 0 | 0 | 0 | 0 |
| 50 | 0 | 0 | 0 | 0 | 2.5 |
| 51 | 0 | 0 | 0 | 0 | 1.0 |
| 52 | 0 | 0 | 0 | 0 | 0 |
| 53 | 0 | 0 | 0 | 0 | 0 |
| 54 | 0 | 0 | 0 | 0 | 0 |
| 55 | 0 | 0 | 0 | 0 | 0 |
| 56 | 0 | 0 | 0 | 0 | 1.0 |
| 57 | 0 | 0 | 0 | 0 | 1.5 |
| 58 | 0 | 0 | 0 | 0 | 1.0 |
| 59 | 0 | 0 | 0 | 0 | 1.0 |
| 60 | 0 | 0 | 0 | 0 | 0 |
| 61 | 0 | 0 | 0 | 0 | 0 |
| 62 | 0 | 0 | 0 | 0 | 0 |
| 63 | 30 | 30 | 0 | 0.4 | 0 |
| 64 | 30 | 30 | 0 | 1.5 | 1.0 |
| 65 | 30 | 30 | 0 | 1.9 | 3.0 |
| 66 | 0 | 0 | 0 | 0 | 0 |
| 67 | 0 | 0 | 0 | 0 | 0 |
| 68 | 0 | 0 | 0 | 0 | .5 |
| 69 | 0 | 0 | 0 | 0 | 1.75 |
| 70 | 0 | 0 | 0 | 0 | 0 |
| 71 | 0 | 0 | 0 | 0 | 0 |
| 72 | 0 | 0 | 0 | 0 | .50 |
| 73 | 0 | 0 | 0 | 0 | 1.75 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq. mile) |
|---|---|---|---|---|---|
| 1074 | 0 | 0 | 0 | 0 | 1.25 |
| 75 | 0 | 0 | 0 | 0 | 0 |
| 76 | 0 | 0 | 0 | 0 | 0 |
| 77 | 0 | 0 | 0 | 0 | 0 |
| 78 | 0 | 0 | 0 | 0 | 0 |
| 79 | 0 | 0 | 0 | 0 | .20 |
| 80 | 0 | 0 | 0 | 0 | .75 |
| 81 | 0 | 0 | 0 | 0 | .50 |
| 82 | 0 | 0 | 0 | 0 | 1.5 |
| 83 | 0 | 0 | 0 | 0 | 1.0 |
| 84 | 0 | 0 | 0 | 0 | 1.25 |
| 85 | 0 | 0 | 0 | 0 | .75 |
| 86 | 0 | 0 | 0 | 0 | 0 |
| 87 | 0 | 0 | 0 | 0 | 0 |
| 88 | 0 | 0 | 0 | 0 | 0 |
| 89 | 0 | 0 | 0 | 0 | .25 |
| 90 | 0 | 0 | 0 | 0 | 1.0 |
| 91 | 0 | 0 | 0 | 0 | 0 |
| 92 | 0 | 0 | 0 | 0 | .50 |
| 93 | 0 | 0 | 0 | 0 | 1.25 |
| 94 | 0 | 0 | 0 | 0 | 1.50 |
| 95 | 0 | 0 | 0 | 0 | 0 |
| 96 | 0 | 0 | 0 | 0 | 0 |
| 97 | 0 | 0 | 0 | 0 | 0 |
| 98 | 0 | 0 | 0 | 0 | 0 |
| 99 | 30 | 30 | 0 | 0.4 | 2.0 |
| 1100 | 30 | 30 | 0 | 1.5 | 2.75 |
| 101 | 30 | 30 | 0 | 0.4 | 0 |
| 102 | 0 | 0 | 0 | 0 | 0 |
| 103 | 0 | 0 | 0 | 0 | 1.75 |
| 104 | 0 | 0 | 0 | 0 | 0 |

| Grid No. | Height in meter | | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| | Maximum | Minimum | | | |
| 1105 | 0 | 0 | 0 | 0 | 0 |
| 106 | 0 | 0 | 0 | 0 | 0 |
| 107 | 0 | 0 | 0 | 0 | .25 |
| 108 | 0 | 0 | 0 | 0 | 1.0 |
| 109 | 0 | 0 | 0 | 0 | 1.75 |
| 110 | 0 | 0 | 0 | 0 | 0 |
| 111 | 0 | 0 | 0 | 0 | 1.25 |
| 112 | 0 | 0 | 0 | 0 | 0 |
| 113 | 0 | 0 | 0 | 0 | 0 |
| 114 | 0 | 0 | 0 | 0 | 0 |
| 115 | 0 | 0 | 0 | 0 | 0 |
| 116 | 0 | 0 | 0 | 0 | 0 |
| 117 | 0 | 0 | 0 | 0 | 1.0 |
| 118 | 0 | 0 | 0 | 0 | 1.0 |
| 119 | 0 | 0 | 0 | 0 | 1.25 |
| 120 | 0 | 0 | 0 | 0 | 0 |
| 121 | 0 | 0 | 0 | 0 | 0 |
| 122 | 0 | 0 | 0 | 0 | 0 |
| 123 | 0 | 0 | 0 | 0 | 0 |
| 124 | 0 | 0 | 0 | 0 | 0 |
| 125 | 0 | 0 | 0 | 0 | 0 |
| 126 | 0 | 0 | 0 | 0 | 0 |
| 127 | 0 | 0 | 0 | 0 | 0 |
| 128 | 0 | 0 | 0 | 0 | 0 |
| 129 | 0 | 0 | 0 | 0 | 2.0 |
| 130 | 0 | 0 | 0 | 0 | .25 |
| 131 | 30 | 30 | 0 | 0.4 | 0 |
| 132 | 30 | 30 | 0 | 0.4 | 1.25 |
| 133 | 0 | 0 | 0 | 0 | 0 |
| 134 | 0 | 0 | 0 | 0 | 0 |
| 135 | 0 | 0 | 0 | 0 | 0 |
| 136 | 0 | 0 | 0 | 0 | 0 |
| 137 | 0 | 0 | 0 | 0 | 0 |
| 138 | 30 | 30 | 0 | 1.7 | .50 |
| 139 | 30 | 30 | 0 | 0.8 | 1.0 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq. mile) |
|---|---|---|---|---|---|
| 1140 | 0 | 0 | 0 | 0 | .75 |
| 141 | 0 | 0 | 0 | 0 | 1.25 |
| 142 | 0 | 0 | 0 | 0 | .50 |
| 143 | 0 | 0 | 0 | 0 | 0 |
| 144 | 0 | 0 | 0 | 0 | 0 |
| 145 | 0 | 0 | 0 | 0 | 0 |
| 146 | 0 | 0 | 0 | 0 | 1.0 |
| 147 | 30 | 30 | 0 | 0.4 | 2.0 |
| 148 | 0 | 0 | 0 | 0 | 2.25 |
| 149 | 0 | 0 | 0 | 0 | 0 |
| 150 | 0 | 0 | 0 | 0 | 0 |
| 151 | 0 | 0 | 0 | 0 | 0 |
| 152 | 0 | 0 | 0 | 0 | 0 |
| 153 | 0 | 0 | 0 | 0 | 0 |
| 154 | 0 | 0 | 0 | 0 | 1.0 |
| 155 | 0 | 0 | 0 | 0 | 1.5 |
| 156 | 0 | 0 | 0 | 0 | 1.0 |
| 157 | 0 | 0 | 0 | 0 | 0 |
| 158 | 0 | 0 | 0 | 0 | 1.0 |
| 159 | 0 | 0 | 0 | 0 | 0 |
| 160 | 0 | 0 | 0 | 0 | 0 |
| 161 | 0 | 0 | 0 | 0 | 0 |
| 162 | 0 | 0 | 0 | 0 | 0 |
| 163 | 0 | 0 | 0 | 0 | 0 |
| 164 | 0 | 0 | 0 | 0 | 0 |
| 165 | 0 | 0 | 0 | 0 | 0 |
| 166 | 0 | 0 | 0 | 0 | 0 |
| 167 | 30 | 30 | 0 | 0.4 | 0 |
| 168 | 30 | 30 | 0 | 0.4 | 0 |
| 169 | 0 | 0 | 0 | 0 | 2.0 |
| 170 | 0 | 0 | 0 | 0 | 2.0 |
| 171 | 0 | 0 | 0 | 0 | 1.0 |
| 172 | 0 | 0 | 0 | 0 | 0 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 1173 | 30 | 30 | 0 | 0.4 | 1.5 |
| 174 | 0 | 0 | 0 | 0 | .50 |
| 175 | 0 | 0 | 0 | 0 | 0 |
| 176 | 0 | 0 | 0 | 0 | 0 |
| 177 | 0 | 0 | 0 | 0 | 0 |
| 178 | 0 | 0 | 0 | 0 | 0 |
| 179 | 30 | 30 | 0 | 0.4 | 0 |
| 180 | 30 | 30 | 0 | 1.9 | 2.0 |
| 181 | 30 | 30 | 0 | 0.8 | 2.5 |
| 182 | 0 | 0 | 0 | 0 | .75 |
| 183 | 0 | 0 | 0 | 0 | 0 |
| 184 | 0 | 0 | 0 | 0 | 0 |
| 185 | 0 | 0 | 0 | 0 | 0 |
| 186 | 0 | 0 | 0 | 0 | 0 |
| 187 | 0 | 0 | 0 | 0 | 0 |
| 188 | 0 | 0 | 0 | 0 | 1.0 |
| 189 | 30 | 30 | 0 | 0.8 | 1.75 |
| 190 | 0 | 0 | 0 | 0 | 0 |
| 191 | 0 | 0 | 0 | 0 | 0 |
| 192 | 0 | 0 | 0 | 0 | 0 |
| 193 | 0 | 0 | 0 | 0 | 0 |
| 194 | 0 | 0 | 0 | 0 | 0 |
| 195 | 0 | 0 | 0 | 0 | 0 |
| 196 | 0 | 0 | 0 | 0 | 1.0 |
| 197 | 0 | 0 | 0 | 0 | 1.0 |
| 198 | 0 | 0 | 0 | 0 | 0 |
| 199 | 0 | 0 | 0 | 0 | 0 |
| 1200 | 0 | 0 | 0 | 0 | 1.5 |
| 201 | 0 | 0 | 0 | 0 | 0 |
| 202 | 0 | 0 | 0 | 0 | 0 |
| 203 | 0 | 0 | 0 | 0 | 0 |
| 204 | 0 | 0 | 0 | 0 | 0 |
| 205 | 0 | 0 | 0 | 0 | 0 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq. mile) |
|---|---|---|---|---|---|
| 1206 | 0 | 0 | 0 | 0 | 0 |
| 207 | 0 | 0 | 0 | 0 | 0 |
| 208 | 0 | 0 | 0 | 0 | 0 |
| 209 | 0 | 0 | 0 | 0 | 0 |
| 210 | 0 | 0 | 0 | 0 | .25 |
| 211 | 30 | 30 | 0 | 0.4 | 1.25 |
| 212 | 30 | 30 | 0 | 0.4 | 1.0 |
| 213 | 30 | 30 | 0 | 0.4 | .5 |
| 214 | 0 | 0 | 0 | 0 | 0 |
| 215 | 0 | 0 | 0 | 0 | 1.5 |
| 216 | 0 | 0 | 0 | 0 | 1.5 |
| 217 | 0 | 0 | 0 | 0 | 3.0 |
| 218 | 0 | 0 | 0 | 0 | 1.0 |
| 219 | 0 | 0 | 0 | 0 | 2.5 |
| 220 | 0 | 0 | 0 | 0 | 0 |
| 221 | 0 | 0 | 0 | 0 | 0 |
| 222 | 0 | 0 | 0 | 0 | 0 |
| 223 | 0 | 0 | 0 | 0 | 0 |
| 224 | 30 | 30 | 0 | 1.3 | 1.75 |
| 225 | 30 | 30 | 0 | 0.8 | 1.0 |
| 226 | 0 | 0 | 0 | 0 | 1.25 |
| 227 | 30 | 30 | 0 | 0.8 | 3.0 |
| 228 | 30 | 30 | 0 | 0.4 | 2.0 |
| 229 | 0 | 0 | 0 | 0 | 0 |
| 230 | 0 | 0 | 0 | 0 | 0 |
| 231 | 0 | 0 | 0 | 0 | .25 |
| 232 | 0 | 0 | 0 | 0 | 2.5 |
| 233 | 30 | 30 | 0 | 0.4 | 1.75 |
| 234 | 0 | 0 | 0 | 0 | .50 |
| 235 | 0 | 0 | 0 | 0 | 1.0 |
| 236 | 0 | 0 | 0 | 0 | 0 |
| 237 | 0 | 0 | 0 | 0 | 0 |
| 238 | 0 | 0 | 0 | 0 | 0 |

| Grid No. | Height in meter | | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| | Maximum | Minimum | | | |
| 1239 | 0 | 0 | 0 | 0 | .5 |
| 240 | 0 | 0 | 0 | 0 | 1.0 |
| 241 | 0 | 0 | 0 | 0 | 0 |
| 242 | 0 | 0 | 0 | 0 | 0 |
| 243 | 0 | 0 | 0 | 0 | 0 |
| 244 | 0 | 0 | 0 | 0 | 1.25 |
| 245 | 0 | 0 | 0 | 0 | 0 |
| 246 | 0 | 0 | 0 | 0 | 0 |
| 247 | 0 | 0 | 0 | 0 | 0 |
| 248 | 0 | 0 | 0 | 0 | 0 |
| 249 | 0 | 0 | 0 | 0 | 0 |
| 250 | 0 | 0 | 0 | 0 | 0 |
| 251 | 0 | 0 | 0 | 0 | 0 |
| 252 | 0 | 0 | 0 | 0 | 0 |
| 253 | 0 | 0 | 0 | 0 | 0 |
| 254 | 0 | 0 | 0 | 0 | 0 |
| 255 | 0 | 0 | 0 | 0 | 0 |
| 256 | 30 | 30 | 0 | 0.4 | 0 |
| 257 | 0 | 0 | 0 | 0 | .5 |
| 258 | 0 | 0 | 0 | 0 | 1.25 |
| 259 | 0 | 0 | 0 | 0 | 1.5 |
| 260 | 0 | 0 | 0 | 0 | 1.0 |
| 261 | 0 | 0 | 0 | 0 | .50 |
| 262 | 0 | 0 | 0 | 0 | 1.25 |
| 263 | 0 | 0 | 0 | 0 | 1.5 |
| 264 | 0 | 0 | 0 | 0 | .75 |
| 265 | 30 | 30 | 0 | 0.4 | 1.0 |
| 266 | 0 | 0 | 0 | 0 | .25 |
| 267 | 30 | 30 | 0 | 0.4 | .5 |
| 268 | 30 | 30 | 0 | 0.8 | .25 |
| 269 | 30 | 30 | 0 | 0.4 | 0 |
| 270 | 0 | 0 | 0 | 0 | 0 |
| 271 | 30 | 30 | 0 | 0.8 | 1.75 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 1272 | 30 | 30 | 0 | 0.4 | .25 |
| 273 | 0 | 0 | 0 | 0 | 0 |
| 274 | 0 | 0 | 0 | 0 | 0 |
| 275 | 0 | 0 | 0 | 0 | 0 |
| 276 | 0 | 0 | 0 | 0 | 0 |
| 277 | 30 | 30 | 0 | 0.4 | 1.5 |
| 278 | 30 | 30 | 0 | 0.8 | 2.0 |
| 279 | 30 | 30 | 0 | 0.4 | 1.0 |
| 280 | 0 | 0 | 0 | 0 | 0 |
| 281 | 0 | 0 | 0 | 0 | 0 |
| 282 | 0 | 0 | 0 | 0 | 0 |
| 283 | 0 | 0 | 0 | 0 | 1.0 |
| 284 | 0 | 0 | 0 | 0 | 1.5 |
| 285 | 0 | 0 | 0 | 0 | 1.0 |
| 286 | 0 | 0 | 0 | 0 | 1.0 |
| 287 | 0 | 0 | 0 | 0 | 0 |
| 288 | 0 | 0 | 0 | 0 | 1.25 |
| 289 | 0 | 0 | 0 | 0 | 0 |
| 290 | 0 | 0 | 0 | 0 | 0 |
| 291 | 0 | 0 | 0 | 0 | 1.5 |
| 292 | 0 | 0 | 0 | 0 | 0 |
| 293 | 0 | 0 | 0 | 0 | 0 |
| 294 | 0 | 0 | 0 | 0 | 0 |
| 295 | 0 | 0 | 0 | 0 | 0 |
| 296 | 0 | 0 | 0 | 0 | 0 |
| 297 | 0 | 0 | 0 | 0 | 0 |
| 298 | 0 | 0 | 0 | 0 | 0 |
| 299 | 0 | 0 | 0 | 0 | 0 |
| 1300 | 30 | 30 | 0 | .4 | 0 |
| 301 | 0 | 0 | 0 | 0 | 0 |
| 302 | 0 | 0 | 0 | 0 | 1.0 |
| 303 | 0 | 0 | 0 | 0 | .25 |
| 304 | 0 | 0 | 0 | 0 | 1.0 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq. mile) |
|---|---|---|---|---|---|
| 1305 | 0 | 0 | 0 | 0 | 0 |
| 306 | 0 | 0 | 0 | 0 | 0 |
| 307 | 0 | 0 | 0 | 0 | 1.75 |
| 308 | 0 | 0 | 0 | 0 | .50 |
| 309 | 30 | 30 | 0 | 0.4 | 1.50 |
| 310 | 30 | 30 | 0 | 0.8 | 1.0 |
| 311 | 0 | 0 | 0 | 0 | .75 |
| 312 | 30 | 30 | 0 | 0.6 | 1.5 |
| 313 | 0 | 0 | 0 | 0 | 2.0 |
| 314 | 30 | 30 | 0 | 0.4 | 1.0 |
| 315 | 30 | 30 | 0 | 0.4 | 1.0 |
| 316 | 0 | 0 | 0 | 0 | 1.0 |
| 317 | 0 | 0 | 0 | 0 | 0 |
| 318 | 0 | 0 | 0 | 0 | 0 |
| 319 | 0 | 0 | 0 | 0 | .50 |
| 320 | 0 | 0 | 0 | 0 | 0 |
| 321 | 0 | 0 | 0 | 0 | 0 |
| 322 | 30 | 30 | 0 | 0.4 | 0 |
| 323 | 0 | 0 | 0 | 0.4 | 2.0 |
| 324 | 0 | 0 | 0 | 0.4 | 0 |
| 325 | 0 | 0 | 0 | 0 | 0 |
| 326 | 0 | 0 | 0 | 0 | 0 |
| 327 | 0 | 0 | 0 | 0 | 1.0 |
| 328 | 0 | 0 | 0 | 0 | .5 |
| 329 | 0 | 0 | 0 | 0 | 1.75 |
| 330 | 0 | 0 | 0 | 0 | 1.5 |
| 331 | 0 | 0 | 0 | 0 | 1.0 |
| 332 | 0 | 0 | 0 | 0 | 1.25 |
| 333 | 0 | 0 | 0 | 0 | 1.5 |
| 334 | 0 | 0 | 0 | 0 | 0 |
| 335 | 0 | 0 | 0 | 0 | 0 |
| 336 | 0 | 0 | 0 | 0 | 1.0 |
| 337 | 0 | 0 | 0 | 0 | 0 |
| 338 | 0 | 0 | 0 | 0 | 0 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density ( per sq. mile ) |
|---|---|---|---|---|---|
| 1339 | 0 | 0 | 0 | 0 | 0 |
| 340 | 0 | 0 | 0 | 0 | 0 |
| 341 | 0 | 0 | 0 | 0 | 0 |
| 342 | 0 | 0 | 0 | 0 | 0 |
| 343 | 0 | 0 | 0 | 0 | 0 |
| 344 | 30 | 30 | 0 | 0.4 | .50 |
| 345 | 30 | 30 | 0 | 0.8 | 1.0 |
| 346 | 30 | 30 | 0 | 0.4 | .50 |
| 347 | 0 | 0 | 0 | 0 | 2.0 |
| 348 | 0 | 0 | 0 | 0 | 1.25 |
| 349 | 0 | 0 | 0 | 0 | 2.0 |
| 350 | 0 | 0 | 0 | 0 | 2.0 |
| 351 | 0 | 0 | 0 | 0 | 0 |
| 352 | 30 | 30 | 0 | 0.4 | 1.0 |
| 353 | 30 | 30 | 0 | 0.4 | 1.0 |
| 354 | 30 | 30 | 0 | 0.4 | .5 |
| 355 | 30 | 30 | 0 | 0.4 | 3.0 |
| 356 | 30 | 30 | 0 | 0.4 | 1.0 |
| 357 | 30 | 30 | 0 | 0.4 | 1.5 |
| 358 | 0 | 0 | 0 | 0 | 2.0 |
| 359 | 0 | 0 | 0 | 0 | 2.5 |
| 360 | 0 | 0 | 0 | 0 | 1.25 |
| 361 | 0 | 0 | 0 | 0 | 1.0 |
| 362 | 0 | 0 | 0 | 0 | .75 |
| 363 | 0 | 0 | 0 | 0 | 0 |
| 364 | 0 | 0 | 0 | 0 | 1.25 |
| 365 | 30 | 30 | 0 | 0.4 | 1.25 |
| 366 | 30 | 30 | 0 | 0.4 | 1.0 |
| 367 | 30 | 30 | 0 | 0.8 | 0 |
| 368 | 30 | 30 | 0 | 0.4 | 1.25 |
| 369 | 30 | 30 | 0 | 0.4 | 1.0 |
| 370 | 0 | 0 | 0 | 0 | 0 |
| 371 | 0 | 0 | 0 | 0 | 0 |
| 372 | 0 | 0 | 0 | 0 | 1.25 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 1373 | 0 | 0 | 0 | 0 | .25 |
| 374 | 0 | 0 | 0 | 0 | 0 |
| 375 | 0 | 0 | 0 | 0 | .50 |
| 376 | 0 | 0 | 0 | 0 | 1.0 |
| 377 | 30 | 30 | 0 | 0.4 | 1.0 |
| 378 | 30 | 30 | 0 | 0.4 | 2.0 |
| 379 | 0 | 0 | 0 | 0 | 0 |
| 380 | 0 | 0 | 0 | 0 | 0 |
| 381 | 0 | 0 | 0 | 0 | 1.0 |
| 382 | 0 | 0 | 0 | 0 | 0 |
| 383 | 0 | 0 | 0 | 0 | 0 |
| 384 | 0 | 0 | 0 | 0 | 0 |
| 385 | 0 | 0 | 0 | 0 | 0 |
| 386 | 0 | 0 | 0 | 0 | 0 |
| 387 | 0 | 0 | 0 | 0 | 0 |
| 388 | 0 | 0 | 0 | 0 | 0 |
| 389 | 0 | 0 | 0 | 0 | 0 |
| 390 | 0 | 0 | 0 | 0.4 | 0 |
| 391 | 0 | 0 | 0 | 0 | .25 |
| 392 | 0 | 0 | 0 | 0 | 0 |
| 393 | 0 | 0 | 0 | 0 | 0 |
| 394 | 0 | 0 | 0 | 0 | 1.0 |
| 395 | 0 | 0 | 0 | 0 | 1.0 |
| 396 | 30 | 30 | 0 | 0.4 | 1.0 |
| 397 | 30 | 30 | 0 | 0.8 | .75 |
| 398 | 30 | 30 | 0 | 0.4 | .50 |
| 399 | 0 | 0 | 0 | 0 | 2.0 |
| 1400 | 0 | 0 | 0 | 0 | .75 |
| 401 | 0 | 0 | 0 | 0 | 1.0 |
| 402 | 30 | 30 | 0 | 0.4 | 1.75 |
| 403 | 30 | 30 | 0 | 0.4 | .5 |
| 404 | 30 | 30 | 0 | 0.4 | .5 |
| 405 | 0 | 0 | 0 | 0 | .75 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 1406 | 0 | 0 | 0 | 0 | 1.0 |
| 407 | 0 | 0 | 0 | 0 | .75 |
| 408 | 0 | 0 | 0 | 0 | 1.5 |
| 409 | 30 | 30 | 0 | 0.4 | 1.0 |
| 410 | 30 | 30 | 0 | 0.8 | 2.0 |
| 411 | 30 | 30 | 0 | 0.4 | 1.75 |
| 412 | 30 | 30 | 0 | 0.4 | 1.50 |
| 413 | 30 | 30 | 0 | 0.4 | 1.0 |
| 414 | 0 | 0 | 0 | 0 | 0 |
| 415 | 0 | 0 | 0 | 0 | 0 |
| 416 | 0 | 0 | 0 | 0 | 2.5 |
| 417 | 0 | 0 | 0 | 0 | .50 |
| 418 | 30 | 30 | 0 | 0.4 | .50 |
| 419 | 30 | 30 | 0 | 0.4 | .50 |
| 420 | 30 | 30 | 0 | 0.4 | 1.75 |
| 421 | 0 | 0 | 0 | 0 | 1.0 |
| 422 | 0 | 0 | 0 | 0.4 | .50 |
| 423 | 0 | 0 | 0 | 0.4 | 1.5 |
| 424 | 0 | 0 | 0 | 0 | 0 |
| 425 | 0 | 0 | 0 | 0 | .25 |
| 426 | 30 | 30 | 0 | 0.4 | 1.75 |
| 427 | 0 | 0 | 0 | 0 | 0 |
| 428 | 0 | 0 | 0 | 0 | 0 |
| 429 | 0 | 0 | 0 | 0 | 0 |
| 430 | 0 | 0 | 0 | 0 | .25 |
| 431 | 0 | 0 | 0 | 0 | 0 |
| 432 | 30 | 30 | 0 | 0.4 | .25 |
| 433 | 30 | 30 | 0 | 0.4 | .25 |
| 434 | 30 | 30 | 0 | 0.4 | 0 |
| 435 | 0 | 0 | 0 | 0 | 0 |
| 436 | 0 | 0 | 0 | 0 | 0 |
| 437 | 0 | 0 | 0 | 0 | 0 |
| 438 | 0 | 0 | 0 | 0 | 0 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 1439 | 0 | 0 | 0 | 0 | 0 |
| 440 | 0 | 0 | 0 | 0 | 0 |
| 441 | 30 | 30 | 0 | 0.4 | .50 |
| 442 | 30 | 30 | 0 | 0.4 | 1.25 |
| 443 | 0 | 0 | 0 | 0 | 1.0 |
| 444 | 0 | 0 | 0 | 0 | 3.5 |
| 445 | 0 | 0 | 0 | 0 | .75 |
| 446 | 0 | 0 | 0 | 0 | 2.0 |
| 447 | 30 | 30 | 0 | 0.4 | .5 |
| 448 | 30 | 30 | 0 | 0.4 | 1.0 |
| 449 | 0 | 0 | 0 | 0 | .5 |
| 450 | 0 | 0 | 0 | 0 | 0 |
| 451 | 0 | 0 | 0 | 0 | 0 |
| 452 | 0 | 0 | 0 | 0 | 0 |
| 453 | 30 | 30 | 0 | 0.4 | 1.25 |
| 454 | 30 | 30 | 0 | 0.4 | 0 |
| 455 | 30 | 30 | 0 | 0.8 | 0.25 |
| 456 | 30 | 30 | 0 | 0.8 | 2.0 |
| 457 | 30 | 30 | 0 | 0.8 | 0.50 |
| 458 | 30 | 30 | 0 | 0.4 | 0 |
| 459 | 0 | 0 | 0 | 0 | 0 |
| 460 | 0 | 0 | 0 | 0 | 0 |
| 461 | 30 | 30 | 0 | 0.6 | 2.0 |
| 462 | 30 | 30 | 0 | 0.4 | 0 |
| 463 | 30 | 30 | 0 | 0.4 | 0 |
| 464 | 30 | 30 | 0 | 0.4 | 0 |
| 465 | 30 | 30 | 0 | 0.4 | 1.5 |
| 466 | 0 | 0 | 0 | 0 | 1.25 |
| 467 | 30 | 30 | 30 | 0.4 | 0 |
| 468 | 30 | 30 | 30 | 0.8 | 2.0 |
| 469 | 30 | 30 | 30 | 0.4 | 0 |
| 470 | 30 | 30 | 30 | 0.4 | 0 |

| Grid No. | Height in meter | | Relative relief | Slope in degree | Drainage density (per sq. mile) |
|---|---|---|---|---|---|
| | Maximum | Minimum | | | |
| 1471 | 30 | 30 | 30 | 0.8 | 1.0 |
| 472 | 30 | 30 | 30 | 0.4 | 0 |
| 473 | 30 | 30 | 30 | 0.4 | 0.25 |
| 474 | 30 | 30 | 30 | 0.4 | 0.75 |
| 475 | 30 | 30 | 30 | 0.4 | 0 |
| 476 | 30 | 30 | 30 | 0.4 | 0 |
| 477 | 30 | 30 | 30 | 0.4 | 1.0 |
| 478 | 0 | 0 | 0 | 0 | 0.75 |
| 479 | 0 | 0 | 0 | 0 | 0 |
| 480 | 0 | 0 | 0 | 0 | 0 |
| 481 | 0 | 0 | 0 | 0 | 0 |
| 482 | 0 | 0 | 0 | 0 | 0 |
| 483 | 0 | 0 | 0 | 0 | 0 |
| 484 | 30 | 30 | 0 | 0.04 | 1.0 |
| 485 | 30 | 30 | 0 | 0.04 | 2.75 |
| 486 | 0 | 0 | 0 | 0 | 2.25 |
| 487 | 0 | 0 | 0 | 0 | 1.0 |
| 488 | 0 | 0 | 0 | 0.4 | 1.0 |
| 489 | 0 | 0 | 0 | 0 | 1.0 |
| 490 | 0 | 0 | 0 | 0 | 1.0 |
| 491 | 0 | 0 | 0 | 0 | 1.0 |
| 492 | 0 | 0 | 0 | 0 | 1.0 |
| 493 | 0 | 0 | 0 | 0 | 0.5 |
| 494 | 0 | 0 | 0 | 0 | 2.0 |
| 495 | 0 | 0 | 0 | 0 | 1.0 |
| 496 | 0 | 0 | 0 | 0 | 1.5 |
| 497 | 0 | 0 | 0 | 0 | 1.0 |
| 498 | 30 | 30 | 0 | 0.4 | 0.5 |
| 499 | 30 | 30 | 0 | 0.4 | 0 |
| 1500 | 30 | 30 | 0 | 0.4 | 0.5 |
| 501 | 25 | 25 | 0 | 0.8 | 2.0 |
| 502 | 0 | 0 | 0 | 0 | 0 |
| 503 | 0 | 0 | 0 | 0 | 0 |

| Grid No. | Height in meter | | Relative relief | Slope in degree | Drainage density ( per sq.mile) |
|---|---|---|---|---|---|
| | Maximum | Minimum | | | |
| 1504 | 0 | 0 | 0 | 0 | 1.0 |
| 505 | 0 | 0 | 0 | 0 | 1.5 |
| 506 | 0 | 0 | 0 | 0 | 1.0 |
| 507 | 0 | 0 | 0 | 0 | 1.0 |
| 508 | 25 | 25 | 0 | 0.8 | 0.5 |
| 509 | 25 | 25 | 0 | 0.4 | 1.5 |
| 510 | 25 | 25 | 0 | 0.4 | 0.5 |
| 511 | 0 | 0 | 0 | 0 | 0 |
| 512 | 25 | 25 | 0 | 0.4 | 1.25 |
| 513 | 25 | 25 | 0 | 0.4 | 0.5 |
| 514 | 0 | 0 | 0 | 0 | 3.5 |
| 515 | 0 | 0 | 0 | 0 | 1.0 |
| 516 | 0 | 0 | 0 | 0 | 0 |
| 517 | 0 | 0 | 0 | 0 | 0 |
| 518 | 0 | 0 | 0 | 0 | 1.5 |
| 519 | 0 | 0 | 0 | 0 | 0 |
| 520 | 0 | 0 | 0 | 0 | 0 |
| 521 | 0 | 0 | 0 | 0 | 0 |
| 522 | 0 | 0 | 0 | 0 | 0 |
| 523 | 0 | 0 | 0 | 0 | 0 |
| 524 | 0 | 0 | 0 | 0 | 0 |
| 525 | 0 | 0 | 0 | 0 | 0 |
| 526 | 0 | 0 | 0 | 0 | 1.75 |
| 527 | 0 | 0 | 0 | 0 | 1.0 |
| 528 | 0 | 0 | 0 | 0 | 2.0 |
| 529 | 0 | 0 | 0 | 0 | 1.5 |
| 530 | 0 | 0 | 0 | 0 | 0 |
| 531 | 0 | 0 | 0 | 0 | 0 |
| 532 | 25 | 25 | 0 | 0.4 | 0 |
| 533 | 0 | 0 | 0 | 0 | 0 |
| 534 | 0 | 0 | 0 | 0 | 0 |
| 535 | 0 | 0 | 0 | 0 | 0 |
| 536 | 0 | 0 | 0 | 0 | 0.5 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 1537 | 25 | 25 | 0 | 0.4 | 2.0 |
| 538 | | | | 0 | 1.5 |
| 539 | | | | 0 | 1.0 |
| 540 | 0 | 0 | 0 | 0 | 3.0 |
| 541 | 0 | 0 | 0 | 0 | 0.5 |
| 542 | 0 | 0 | 0 | 0 | 0 |
| 543 | 0 | 0 | 0 | 0 | 0 |
| 544 | 0 | 0 | 0 | 0 | 0 |
| 545 | 0 | 0 | 0 | 0 | 2.0 |
| 546 | 0 | 0 | 0 | 0 | 0 |
| 547 | 0 | 0 | 0 | 0 | 0 |
| 548 | 0 | 0 | 0 | 0 | 2.0 |
| 549 | 0 | 0 | 0 | 0 | 1.25 |
| 550 | 0 | 0 | 0 | 0 | 0.5 |
| 551 | 0 | 0 | 0 | 0 | 1.0 |
| 552 | 25 | 25 | 0 | 0.4 | 1.0 |
| 553 | 25 | 25 | 0 | 0.4 | 1.75 |
| 554 | 0 | 0 | 0 | 0 | 0.50 |
| 555 | 0 | 0 | 0 | 0 | 0 |
| 556 | 0 | 0 | 0 | 0 | 1.0 |
| 557 | 0 | 0 | 0 | 0 | 0 |
| 558 | 0 | 0 | 0 | 0 | 0.5 |
| 559 | 0 | 0 | 0 | 0 | 0.5 |
| 560 | 0 | 0 | 0 | 0 | 0.75 |
| 561 | 0 | 0 | 0 | 0 | 0 |
| 562 | 0 | 0 | 0 | 0 | 1.0 |
| 563 | 0 | 0 | 0 | 0 | 0.5 |
| 564 | 0 | 0 | 0 | 0 | 0 |
| 565 | 0 | 0 | 0 | 0 | 0 |
| 566 | 0 | 0 | 0 | 0 | 0 |
| 567 | 0 | 0 | 0 | 0 | 0 |
| 568 | 0 | 0 | 0 | 0 | 0 |
| 569 | 0 | 0 | 0 | 0 | 0 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 1570 | 0 | 0 | 0 | 0 | 2.0 |
| 571 | 0 | 0 | 0 | 0 | 2.0 |
| 572 | 25 | 25 | 0 | 0 | 1.5 |
| 573 | 25 | 25 | 0 | 0.4 | 0 |
| 574 | 25 | 25 | 0 | 0.8 | 0 |
| 575 | 25 | 25 | 0 | 0.4 | 0 |
| 576 | 0 | 0 | 0 | 0 | 0 |
| 577 | 0 | 0 | 0 | 0 | 0 |
| 578 | 0 | 0 | 0 | 0 | 0 |
| 579 | 0 | 0 | 0 | 0 | 1.0 |
| 580 | 25 | 25 | 0 | 0.4 | 1.75 |
| 581 | 0 | 0 | 0 | 0 | 0 |
| 582 | 0 | 0 | 0 | 0 | 0 |
| 583 | 0 | 0 | 0 | 0 | 2.5 |
| 584 | 0 | 0 | 0 | 0 | 0.5 |
| 585 | 0 | 0 | 0 | 0 | 1.5 |
| 586 | 0 | 0 | 0 | 0 | 0.75 |
| 587 | 0 | 0 | 0 | 0 | 0.5 |
| 588 | 0 | 0 | 0 | 0 | 0 |
| 589 | 0 | 0 | 0 | 0 | 1.75 |
| 590 | 0 | 0 | 0 | 0 | 0 |
| 591 | 0 | 0 | 0 | 0 | 0 |
| 592 | 0 | 0 | 0 | 0 | 1.0 |
| 593 | 0 | 0 | 0 | 0 | 2.5 |
| 594 | 0 | 0 | 0 | 0 | 0.5 |
| 595 | 0 | 0 | 0 | 0 | 1.0 |
| 596 | 0 | 0 | 0 | 0 | 1.0 |
| 597 | 0 | 0 | 0 | 0 | 1.0 |
| 598 | 0 | 0 | 0 | 0 | 2.5 |
| 599 | 0 | 0 | 0 | 0 | 0.5 |
| 1600 | 0 | 0 | 0 | 0 | 1.0 |
| 601 | 0 | 0 | 0 | 0 | 0 |
| 602 | 0 | 0 | 0 | 0 | 0 |
| 603 | 0 | 0 | 0 | 0 | 0.75 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq. mile) |
|---|---|---|---|---|---|
| 1604 | 0 | 0 | 0 | 0 | 1.75 |
| 605 | 0 | 0 | 0 | 0 | 0 |
| 606 | 0 | 0 | 0 | 0 | 0 |
| 607 | 0 | 0 | 0 | 0 | 1.5 |
| 608 | 0 | 0 | 0 | 0 | 0 |
| 609 | 0 | 0 | 0 | 0 | 0 |
| 610 | 0 | 0 | 0 | 0 | 0 |
| 611 | 0 | 0 | 0 | 0 | 0.5 |
| 612 | 0 | 0 | 0 | 0 | 0.5 |
| 613 | 0 | 0 | 0 | 0 | 0 |
| 614 | 0 | 0 | 0 | 0 | 0 |
| 615 | 25 | 25 | 0 | 0.4 | 0 |
| 616 | 0 | 0 | 0 | 0 | 0 |
| 617 | 0 | 0 | 0 | 0 | 0 |
| 618 | 0 | 0 | 0 | 0 | 1.5 |
| 619 | 0 | 0 | 0 | 0 | 1.0 |
| 620 | 0 | 0 | 0 | 0 | 1.5 |
| 621 | 0 | 0 | 0 | 0 | 1.25 |
| 622 | 0 | 0 | 0 | 0 | 0.25 |
| 623 | 25 | 25 | 0 | 0.6 | 0 |
| 624 | 25 | 25 | 0 | 1.3 | 0 |
| 625 | 25 | 25 | 0 | 0.4 | 0 |
| 626 | 25 | 25 | 0 | 0.4 | 0 |
| 627 | 25 | 25 | 0 | 0.4 | 0 |
| 628 | 25 | 25 | 0 | 0.4 | 0 |
| 629 | 25 | 25 | 0 | 0.4 | 0 |
| 630 | 25 | 25 | 0 | 0.4 | 0 |
| 631 | 0 | 0 | 0 | 0 | 0 |
| 632 | 0 | 0 | 0 | 0 | 0 |
| 633 | 0 | 0 | 0 | 0 | 0.5 |
| 634 | 0 | 0 | 0 | 0 | 2.0 |
| 635 | 0 | 0 | 0 | 0 | 1.0 |
| 636 | 0 | 0 | 0 | 0 | 2.0 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq. mile) |
|---|---|---|---|---|---|
| 1637 | 0 | 0 | 0 | 0 | 0.25 |
| 638 | 0 | 0 | 0 | 0 | 0.50 |
| 639 | 0 | 0 | 0 | 0 | 1.0 |
| 640 | 0 | 0 | 0 | 0 | 0 |
| 641 | 0 | 0 | 0 | 0 | 0 |
| 642 | 0 | 0 | 0 | 0 | 1.5 |
| 643 | 0 | 0 | 0 | 0 | 2.0 |
| 644 | 0 | 0 | 0 | 0 | 0.5 |
| 645 | 0 | 0 | 0 | 0 | 1.0 |
| 646 | 0 | 0 | 0 | 0 | 0.5 |
| 647 | 0 | 0 | 0 | 0 | 0.5 |
| 648 | 0 | 0 | 0 | 0 | 1.25 |
| 649 | 0 | 0 | 0 | 0 | 3.5 |
| 650 | 0 | 0 | 0 | 0 | 1.5 |
| 651 | 0 | 0 | 0 | 0 | 0 |
| 652 | 0 | 0 | 0 | 0 | 0 |
| 653 | 0 | 0 | 0 | 0 | 0 |
| 654 | 0 | 0 | 0 | 0 | 0.5 |
| 655 | 0 | 0 | 0 | 0 | 1.25 |
| 656 | 0 | 0 | 0 | 0 | 0.75 |
| 657 | 0 | 0 | 0 | 0 | 1.0 |
| 658 | 0 | 0 | 0 | 0 | 0.5 |
| 659 | 0 | 0 | 0 | 0 | 0 |
| 660 | 0 | 0 | 0 | 0 | 0 |
| 661 | 0 | 0 | 0 | 0 | 0.25 |
| 662 | 0 | 0 | 0 | 0 | 0.5 |
| 663 | 0 | 0 | 0 | 0 | 1.5 |
| 664 | 0 | 0 | 0 | 0 | 0 |
| 665 | 0 | 0 | 0 | 0 | 0 |
| 666 | 0 | 0 | 0 | 0 | 1.0 |
| 667 | 0 | 0 | 0 | 0 | 0 |
| 668 | 0 | 0 | 0 | 0 | 0 |
| 669 | 0 | 0 | 0 | 0 | 0 |
| 670 | 0 | 0 | 0 | 0 | 0.75 |
| 671 | 0 | 0 | 0 | 0 | 1.25 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq. mile) |
|---|---|---|---|---|---|
| 1672 | 0 | 0 | 0 | 0 | 0 |
| 673 | 0 | 0 | 0 | 0 | 1.0 |
| 674 | 0 | 0 | 0 | 0 | 2.0 |
| 675 | 0 | 0 | 0 | 0 | 0 |
| 676 | 0 | 0 | 0 | 0 | 0 |
| 677 | 0 | 0 | 0 | 0 | 1.0 |
| 678 | 0 | 0 | 0 | 0 | 2.0 |
| 679 | 0 | 0 | 0 | 0 | 0.5 |
| 680 | 0 | 0 | 0 | 0 | 0 |
| 681 | 0 | 0 | 0 | 0 | 0 |
| 682 | 0 | 0 | 0 | 0 | 0 |
| 683 | 0 | 0 | 0 | 0 | 0 |
| 684 | 0 | 0 | 0 | 0 | 1.0 |
| 685 | 0 | 0 | 0 | 0 | 1.0 |
| 686 | 0 | 0 | 0 | 0 | 0 |
| 687 | 0 | 0 | 0 | 0 | 0 |
| 688 | 0 | 0 | 0 | 0 | 0 |
| 689 | 0 | 0 | 0 | 0 | 0 |
| 690 | 0 | 0 | 0 | 0 | 0.75 |
| 691 | 0 | 0 | 0 | 0 | 1.0 |
| 692 | 0 | 0 | 0 | 0 | 0.5 |
| 693 | 0 | 0 | 0 | 0 | 0 |
| 694 | 0 | 0 | 0 | 0 | 0.5 |
| 695 | 0 | 0 | 0 | 0 | 2.0 |
| 696 | 0 | 0 | 0 | 0 | 1.25 |
| 697 | 0 | 0 | 0 | 0 | 1.0 |
| 698 | 0 | 0 | 0 | 0 | 0 |
| 699 | 0 | 0 | 0 | 0 | 0 |
| 1700 | 0 | 0 | 0 | 0 | 0 |
| 701 | 0 | 0 | 0 | 0 | 1.0 |
| 702 | 0 | 0 | 0 | 0 | 0 |
| 703 | 0 | 0 | 0 | 0 | 1.0 |
| 704 | 0 | 0 | 0 | 0 | 1.0 |
| 705 | 0 | 0 | 0 | 0 | 1.25 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq. mile) |
|---|---|---|---|---|---|
| 1706 | 0 | 0 | 0 | 0 | 1.0 |
| 707 | 0 | 0 | 0 | 0 | 0.5 |
| 708 | 0 | 0 | 0 | 0 | 0.25 |
| 709 | 0 | 0 | 0 | 0 | 1.5 |
| 710 | 0 | 0 | 0 | 0 | 0 |
| 711 | 0 | 0 | 0 | 0 | 0 |
| 712 | 0 | 0 | 0 | 0 | 0 |
| 713 | 0 | 0 | 0 | 0 | 0 |
| 714 | 0 | 0 | 0 | 0 | 1.0 |
| 715 | 0 | 0 | 0 | 0 | 2.0 |
| 716 | 0 | 0 | 0 | 0 | 1.0 |
| 717 | 0 | 0 | 0 | 0 | 3.0 |
| 718 | 0 | 0 | 0 | 0 | 1.75 |
| 719 | 0 | 0 | 0 | 0 | 3.0 |
| 720 | 0 | 0 | 0 | 0 | 3.0 |
| 721 | 0 | 0 | 0 | 0 | 3.5 |
| 722 | 0 | 0 | 0 | 0 | 1.0 |
| 723 | 0 | 0 | 0 | 0 | 0 |
| 724 | 0 | 0 | 0 | 0 | 0 |
| 725 | 0 | 0 | 0 | 0 | 0 |
| 726 | 0 | 0 | 0 | 0 | 1.5 |
| 727 | 0 | 0 | 0 | 0 | 0 |
| 728 | 0 | 0 | 0 | 0 | 0 |
| 729 | 0 | 0 | 0 | 0 | 0.5 |
| 730 | 0 | 0 | 0 | 0 | 2.0 |
| 731 | 0 | 0 | 0 | 0 | 2.5 |
| 732 | 0 | 0 | 0 | 0 | 2.0 |
| 733 | 0 | 0 | 0 | 0 | 1.5 |
| 734 | 0 | 0 | 0 | 0 | 1.0 |
| 735 | 0 | 0 | 0 | 0 | 0.25 |
| 736 | 0 | 0 | 0 | 0 | 1.5 |
| 737 | 0 | 0 | 0 | 0 | 0.5 |
| 738 | 0 | 0 | 0 | 0 | 0.25 |
| 739 | 0 | 0 | 0 | 0 | 0 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 1740 | 0 | 0 | 0 | 0 | 0 |
| 741 | 0 | 0 | 0 | 0 | 0 |
| 742 | 0 | 0 | 0 | 0 | 0 |
| 743 | 0 | 0 | 0 | 0 | 1.5 |
| 744 | 0 | 0 | 0 | 0 | 0.75 |
| 745 | 0 | 0 | 0 | 0 | 0 |
| 746 | 0 | 0 | 0 | 0 | 0 |
| 747 | 0 | 0 | 0 | 0 | 0 |
| 748 | 0 | 0 | 0 | 0 | 0 |
| 749 | 0 | 0 | 0 | 0 | 0 |
| 750 | 0 | 0 | 0 | 0 | 1.5 |
| 751 | 0 | 0 | 0 | 0 | 0.75 |
| 752 | 0 | 0 | 0 | 0 | 0 |
| 753 | 0 | 0 | 0 | 0 | 0 |
| 754 | 0 | 0 | 0 | 0 | 0 |
| 755 | 0 | 0 | 0 | 0 | 2.0 |
| 756 | 0 | 0 | 0 | 0 | 0 |
| 757 | 0 | 0 | 0 | 0 | 0 |
| 758 | 0 | 0 | 0 | 0 | 0 |
| 759 | 0 | 0 | 0 | 0 | 0 |
| 760 | 0 | 0 | 0 | 0 | 0 |
| 761 | 0 | 0 | 0 | 0 | 0.5 |
| 762 | 0 | 0 | 0 | 0 | 2.0 |
| 763 | 0 | 0 | 0 | 0 | 1.25 |
| 764 | 0 | 0 | 0 | 0 | 1.0 |
| 765 | 0 | 0 | 0 | 0 | 0.5 |
| 766 | 0 | 0 | 0 | 0 | 1.0 |
| 767 | 0 | 0 | 0 | 0 | 2.25 |
| 768 | 0 | 0 | 0 | 0 | 2.25 |
| 769 | 0 | 0 | 0 | 0 | 1.75 |
| 770 | 0 | 0 | 0 | 0 | 2.75 |
| 771 | 0 | 0 | 0 | 0 | 2.0 |
| 772 | 0 | 0 | 0 | 0 | 0.5 |

| Grid No. | Height in meter | | Relative relief | Slope in degree | Drainage density (per sq. mile) |
|---|---|---|---|---|---|
| | Maximum | Minimum | | | |
| 1773 | 0 | 0 | 0 | 0 | 0.5 |
| 774 | 0 | 0 | 0 | 0 | 3.0 |
| 775 | 0 | 0 | 0 | 0 | 4.0 |
| 776 | 0 | 0 | 0 | 0 | 3.0 |
| 777 | 0 | 0 | 0 | 0 | 1.0 |
| 778 | 0 | 0 | 0 | 0 | 3.0 |
| 779 | 0 | 0 | 0 | 0 | 2.0 |
| 780 | 0 | 0 | 0 | 0 | 2.75 |
| 781 | 0 | 0 | 0 | 0 | 3.5 |
| 782 | 0 | 0 | 0 | 0 | 0.5 |
| 783 | 0 | 0 | 0 | 0 | 2.0 |
| 784 | 0 | 0 | 0 | 0 | 2.5 |
| 785 | 0 | 0 | 0 | 0 | 1.5 |
| 786 | 0 | 0 | 0 | 0 | 1.0 |
| 787 | 0 | 0 | 0 | 0 | 0 |
| 788 | 0 | 0 | 0 | 0 | 0 |
| 789 | 0 | 0 | 0 | 0 | 0 |
| 790 | 0 | 0 | 0 | 0 | 0.25 |
| 791 | 0 | 0 | 0 | 0 | 3.0 |
| 792 | 0 | 0 | 0 | 0 | 2.5 |
| 793 | 0 | 0 | 0 | 0 | 0.5 |
| 794 | 0 | 0 | 0 | 0 | 0.5 |
| 795 | 0 | 0 | 0 | 0 | 3.0 |
| 796 | 0 | 0 | 0 | 0 | 1.0 |
| 797 | 0 | 0 | 0 | 0 | 1.25 |
| 798 | 0 | 0 | 0 | 0 | 2.0 |
| 799 | 0 | 0 | 0 | 0 | 1.0 |
| 1800 | 0 | 0 | 0 | 0 | 0 |
| 801 | 0 | 0 | 0 | 0 | 0 |
| 802 | 0 | 0 | 0 | 0 | 0 |
| 803 | 0 | 0 | 0 | 0 | 0 |
| 804 | 0 | 0 | 0 | 0 | 0 |
| 805 | 0 | 0 | 0 | 0 | 1.0 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 1806 | 0 | 0 | 0 | 0 | 0.5 |
| 807 | 0 | 0 | 0 | 0 | 2.0 |
| 808 | 0 | 0 | 0 | 0 | 1.0 |
| 809 | 0 | 0 | 0 | 0 | 0 |
| 810 | 0 | 0 | 0 | 0 | 0 |
| 811 | 0 | 0 | 0 | 0 | 0 |
| 812 | 0 | 0 | 0 | 0 | 0 |
| 813 | 0 | 0 | 0 | 0 | 0 |
| 814 | 0 | 0 | 0 | 0 | 0 |
| 815 | 0 | 0 | 0 | 0 | 1.0 |
| 816 | 0 | 0 | 0 | 0 | 1.5 |
| 817 | 0 | 0 | 0 | 0 | 1.0 |
| 818 | 0 | 0 | 0 | 0 | 1.5 |
| 819 | 0 | 0 | 0 | 0 | 0 |
| 820 | 0 | 0 | 0 | 0 | 0 |
| 821 | 0 | 0 | 0 | 0 | 0 |
| 822 | 0 | 0 | 0 | 0 | 0 |
| 823 | 0 | 0 | 0 | 0 | 0 |
| 824 | 0 | 0 | 0 | 0 | 0 |
| 825 | 0 | 0 | 0 | 0 | 0 |
| 826 | 0 | 0 | 0 | 0 | 0.75 |
| 827 | 0 | 0 | 0 | 0 | 1.5 |
| 828 | 0 | 0 | 0 | 0 | 0 |
| 829 | 0 | 0 | 0 | 0 | 0 |
| 830 | 0 | 0 | 0 | 0 | 1.0 |
| 831 | 0 | 0 | 0 | 0 | 2.0 |
| 832 | 0 | 0 | 0 | 0 | 1.0 |
| 833 | 0 | 0 | 0 | 0 | 0 |
| 834 | 0 | 0 | 0 | 0 | 2.0 |
| 835 | 0 | 0 | 0 | 0 | 3.0 |
| 836 | 0 | 0 | 0 | 0 | 1.75 |
| 837 | 0 | 0 | 0 | 0 | 3.5 |
| 838 | 0 | 0 | 0 | 0 | 2.5 |
| 839 | 0 | 0 | 0 | 0 | 2.5 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 1840 | 0 | 0 | 0 | 0 | 1.25 |
| 841 | 0 | 0 | 0 | 0 | 1.0 |
| 842 | 0 | 0 | 0 | 0 | 1.5 |
| 843 | 0 | 0 | 0 | 0 | 1.0 |
| 844 | 0 | 0 | 0 | 0 | 0.25 |
| 845 | 0 | 0 | 0 | 0 | 0.75 |
| 846 | 0 | 0 | 0 | 0 | 0 |
| 847 | 0 | 0 | 0 | 0 | 0 |
| 848 | 0 | 0 | 0 | 0 | 0 |
| 849 | 0 | 0 | 0 | 0 | 2.0 |
| 850 | 0 | 0 | 0 | 0 | 0 |
| 851 | 0 | 0 | 0 | 0 | 1.0 |
| 852 | 0 | 0 | 0 | 0 | 0 |
| 853 | 0 | 0 | 0 | 0 | 0 |
| 854 | 0 | 0 | 0 | 0 | 0 |
| 855 | 0 | 0 | 0 | 0 | 0 |
| 856 | 0 | 0 | 0 | 0 | 0 |
| 857 | 0 | 0 | 0 | 0 | 0 |
| 858 | 0 | 0 | 0 | 0 | 1.0 |
| 859 | 0 | 0 | 0 | 0 | 1.0 |
| 860 | 0 | 0 | 0 | 0 | 0.25 |
| 861 | 0 | 0 | 0 | 0 | 2.5 |
| 862 | 0 | 0 | 0 | 0 | 1.25 |
| 863 | 0 | 0 | 0 | 0 | 1.0 |
| 864 | 0 | 0 | 0 | 0 | 1.5 |
| 865 | 0 | 0 | 0 | 0 | 0.25 |
| 866 | 0 | 0 | 0 | 0 | 0 |
| 867 | 0 | 0 | 0 | 0 | 0 |
| 868 | 0 | 0 | 0 | 0 | 0 |
| 869 | 0 | 0 | 0 | 0 | 0 |
| 870 | 0 | 0 | 0 | 0 | 0 |
| 871 | 0 | 0 | 0 | 0 | 0.75 |
| 872 | 0 | 0 | 0 | 0 | 1.0 |

| Grid No. | Height in meter | | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| | Maximum | Minimum | | | |
| 1873 | 0 | 0 | 0 | 0 | 0 |
| 874 | 0 | 0 | 0 | 0 | 0 |
| 875 | 0 | 0 | 0 | 0 | 1.0 |
| 876 | 0 | 0 | 0 | 0 | 1.0 |
| 877 | 0 | 0 | 0 | 0 | 0 |
| 878 | 0 | 0 | 0 | 0 | 0 |
| 879 | 0 | 0 | 0 | 0 | 0 |
| 880 | 0 | 0 | 0 | 0 | 0 |
| 881 | 0 | 0 | 0 | 0 | 0 |
| 882 | 0 | 0 | 0 | 0 | 1.5 |
| 883 | 0 | 0 | 0 | 0 | 1.75 |
| 884 | 0 | 0 | 0 | 0 | 0 |
| 885 | 0 | 0 | 0 | 0 | 0 |
| 886 | 0 | 0 | 0 | 0 | 0 |
| 887 | 0 | 0 | 0 | 0 | 0 |
| 888 | 0 | 0 | 0 | 0 | 0 |
| 889 | 0 | 0 | 0 | 0 | 0 |
| 890 | 0 | 0 | 0 | 0 | 0 |
| 891 | 0 | 0 | 0 | 0 | 0 |
| 892 | 0 | 0 | 0 | 0 | 2.0 |
| 893 | 0 | 0 | 0 | 0 | 2.0 |
| 894 | 0 | 0 | 0 | 0 | 0.5 |
| 895 | 0 | 0 | 0 | 0 | 1.0 |
| 896 | 0 | 0 | 0 | 0 | 0.5 |
| 897 | 0 | 0 | 0 | 0 | 1.0 |
| 898 | 0 | 0 | 0 | 0 | 1.0 |
| 899 | 0 | 0 | 0 | 0 | 0 |
| 1900 | 0 | 0 | 0 | 0 | 1.25 |
| 901 | 0 | 0 | 0 | 0 | 2.0 |
| 902 | 0 | 0 | 0 | 0 | 1.5 |
| 903 | 0 | 0 | 0 | 0 | 1.5 |
| 904 | 0 | 0 | 0 | 0 | 1.0 |
| 905 | 0 | 0 | 0 | 0 | 1.0 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 1906 | 0 | 0 | 0 | 0 | 0.75 |
| 907 | 0 | 0 | 0 | 0 | 0 |
| 908 | 0 | 0 | 0 | 0 | 0.5 |
| 909 | 0 | 0 | 0 | 0 | 1.5 |
| 910 | 0 | 0 | 0 | 0 | 0.5 |
| 911 | 0 | 0 | 0 | 0 | 2.0 |
| 912 | 0 | 0 | 0 | 0 | 1.5 |
| 913 | 0 | 0 | 0 | 0 | 1.0 |
| 914 | 0 | 0 | 0 | 0 | 0.25 |
| 915 | 0 | 0 | 0 | 0 | 0.5 |
| 916 | 0 | 0 | 0 | 0 | 0 |
| 917 | 0 | 0 | 0 | 0 | 0.5 |
| 918 | 0 | 0 | 0 | 0 | 0 |
| 919 | 0 | 0 | 0 | 0 | 0 |
| 920 | 0 | 0 | 0 | 0 | 1.0 |
| 921 | 0 | 0 | 0 | 0 | 2.75 |
| 922 | 0 | 0 | 0 | 0 | 2.0 |
| 923 | 0 | 0 | 0 | 0 | 3.0 |
| 924 | 0 | 0 | 0 | 0 | 0.5 |
| 925 | 0 | 0 | 0 | 0 | 1.5 |
| 926 | 0 | 0 | 0 | 0 | 0 |
| 927 | 0 | 0 | 0 | 0 | 0 |
| 928 | 0 | 0 | 0 | 0 | 0 |
| 929 | 0 | 0 | 0 | 0 | 0 |
| 930 | 0 | 0 | 0 | 0 | 0 |
| 931 | 0 | 0 | 0 | 0 | 0 |
| 932 | 0 | 0 | 0 | 0 | 0 |
| 933 | 0 | 0 | 0 | 0 | 1.0 |
| 934 | 0 | 0 | 0 | 0 | 0.5 |
| 935 | 0 | 0 | 0 | 0 | 0 |
| 936 | 0 | 0 | 0 | 0 | 0 |
| 937 | 0 | 0 | 0 | 0 | 0.5 |
| 938 | 0 | 0 | 0 | 0 | 0.5 |
| 939 | 0 | 0 | 0 | 0 | 0 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 1940 | 0 | 0 | 0 | 0 | 0 |
| 941 | 0 | 0 | 0 | 0 | 0 |
| 942 | 0 | 0 | 0 | 0 | 0 |
| 943 | 0 | 0 | 0 | 0 | 0 |
| 944 | 0 | 0 | 0 | 0 | 0.5 |
| 945 | 0 | 0 | 0 | 0 | 2.0 |
| 946 | 0 | 0 | 0 | 0 | 0 |
| 947 | 0 | 0 | 0 | 0 | 0 |
| 948 | 0 | 0 | 0 | 0 | 0 |
| 949 | 0 | 0 | 0 | 0 | 0 |
| 950 | 0 | 0 | 0 | 0 | 0 |
| 951 | 0 | 0 | 0 | 0 | 0 |
| 952 | 0 | 0 | 0 | 0 | 0 |
| 953 | 0 | 0 | 0 | 0 | 0 |
| 954 | 0 | 0 | 0 | 0 | 0 |
| 955 | 0 | 0 | 0 | 0 | 0.25 |
| 956 | 0 | 0 | 0 | 0 | 0.75 |
| 957 | 0 | 0 | 0 | 0 | 1.0 |
| 958 | 0 | 0 | 0 | 0 | 1.0 |
| 959 | 0 | 0 | 0 | 0 | 1.0 |
| 960 | 0 | 0 | 0 | 0 | 1.0 |
| 961 | 0 | 0 | 0 | 0 | 1.0 |
| 962 | 0 | 0 | 0 | 0 | 1.0 |
| 963 | 0 | 0 | 0 | 0 | 1.5 |
| 964 | 0 | 0 | 0 | 0 | 1.5 |
| 965 | 0 | 0 | 0 | 0 | 1.0 |
| 966 | 0 | 0 | 0 | 0 | 0.25 |
| 967 | 0 | 0 | 0 | 0 | 0 |
| 968 | 0 | 0 | 0 | 0 | 0 |
| 969 | 0 | 0 | 0 | 0 | 0 |
| 970 | 0 | 0 | 0 | 0 | 0.5 |
| 971 | 0 | 0 | 0 | 0 | 0 |
| 972 | 0 | 0 | 0 | 0 | 0 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 1973 | 0 | 0 | 0 | 0 | 1.0 |
| 974 | 0 | 0 | 0 | 0 | 1.75 |
| 975 | 0 | 0 | 0 | 0 | 1.5 |
| 976 | 0 | 0 | 0 | 0 | 0.75 |
| 977 | 0 | 0 | 0 | 0 | 1.0 |
| 978 | 0 | 0 | 0 | 0 | 0.75 |
| 979 | 0 | 0 | 0 | 0 | 0 |
| 980 | 0 | 0 | 0 | 0 | 0 |
| 981 | 0 | 0 | 0 | 0 | 0 |
| 982 | 0 | 0 | 0 | 0 | 0.75 |
| 983 | 0 | 0 | 0 | 0 | 2.0 |
| 984 | 0 | 0 | 0 | 0 | 2.0 |
| 985 | 0 | 0 | 0 | 0 | 1.25 |
| 986 | 0 | 0 | 0 | 0 | 1.0 |
| 987 | 0 | 0 | 0 | 0 | 0.5 |
| 988 | 0 | 0 | 0 | 0 | 0 |
| 989 | 0 | 0 | 0 | 0 | 0 |
| 990 | 0 | 0 | 0 | 0 | 0 |
| 991 | 0 | 0 | 0 | 0 | 1.0 |
| 992 | 0 | 0 | 0 | 0 | 0 |
| 993 | 0 | 0 | 0 | 0 | 0 |
| 994 | 0 | 0 | 0 | 0 | 1.5 |
| 995 | 0 | 0 | 0 | 0 | 0.25 |
| 996 | 0 | 0 | 0 | 0 | 0 |
| 997 | 0 | 0 | 0 | 0 | 0 |
| 998 | 0 | 0 | 0 | 0 | 0.25 |
| 999 | 0 | 0 | 0 | 0 | 1.5 |
| 2000 | 0 | 0 | 0 | 0 | 1.0 |
| 1 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 1.0 |
| 4 | 0 | 0 | 0 | 0 | 1.0 |
| 5 | 0 | 0 | 0 | 0 | 1.5 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 2006 | 0 | 0 | 0 | 0 | 0.5 |
| 7 | 0 | 0 | 0 | 0 | 0 |
| 8 | 0 | 0 | 0 | 0 | 0 |
| 9 | 0 | 0 | 0 | 0 | 0 |
| 10 | 0 | 0 | 0 | 0 | 0.5 |
| 11 | 0 | 0 | 0 | 0 | 0.75 |
| 12 | 0 | 0 | 0 | 0 | 0 |
| 13 | 0 | 0 | 0 | 0 | 0 |
| 14 | 0 | 0 | 0 | 0 | 0.5 |
| 15 | 0 | 0 | 0 | 0 | 1.0 |
| 16 | 0 | 0 | 0 | 0 | 1.5 |
| 17 | 0 | 0 | 0 | 0 | 0.75 |
| 18 | 0 | 0 | 0 | 0 | 0.5 |
| 19 | 0 | 0 | 0 | 0 | 1.0 |
| 20 | 0 | 0 | 0 | 0 | 1.0 |
| 21 | 0 | 0 | 0 | 0 | 1.5 |
| 22 | 0 | 0 | 0 | 0 | 1.5 |
| 23 | 0 | 0 | 0 | 0 | 1.0 |
| 24 | 0 | 0 | 0 | 0 | 1.0 |
| 25 | 0 | 0 | 0 | 0 | 1.0 |
| 26 | 0 | 0 | 0 | 0 | 1.0 |
| 27 | 0 | 0 | 0 | 0 | 0.5 |
| 28 | 0 | 0 | 0 | 0 | 1.0 |
| 29 | 0 | 0 | 0 | 0 | 1.0 |
| 30 | 0 | 0 | 0 | 0 | 1.0 |
| 31 | 0 | 0 | 0 | 0 | 0.5 |
| 32 | 0 | 0 | 0 | 0 | 0 |
| 33 | 0 | 0 | 0 | 0 | 0 |
| 34 | 0 | 0 | 0 | 0 | 1.5 |
| 35 | 0 | 0 | 0 | 0 | 1.5 |
| 36 | 0 | 0 | 0 | 0 | 1.0 |
| 37 | 0 | 0 | 0 | 0 | 0 |
| 38 | 0 | 0 | 0 | 0 | 1.0 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 2039 | 0 | 0 | 0 | 0 | 1.0 |
| 40 | 0 | 0 | 0 | 0 | 0 |
| 41 | 0 | 0 | 0 | 0 | 0 |
| 42 | 0 | 0 | 0 | 0 | 1.25 |
| 43 | 0 | 0 | 0 | 0 | 1.0 |
| 44 | 0 | 0 | 0 | 0 | 2.0 |
| 45 | 0 | 0 | 0 | 0 | 1.0 |
| 46 | 0 | 0 | 0 | 0 | 1.0 |
| 47 | 0 | 0 | 0 | 0 | 0.75 |
| 48 | 0 | 0 | 0 | 0 | 0 |
| 49 | 0 | 0 | 0 | 0 | 0 |
| 50 | 20 | 20 | 0 | 0 | 0.5 |
| 51 | 0 | 0 | 0 | 0 | 1.5 |
| 52 | 0 | 0 | 0 | 0 | 0 |
| 53 | 20 | 20 | 0 | 0.4 | 0 |
| 54 | 20 | 20 | 0 | 0.4 | 1.5 |
| 55 | 0 | 0 | 0 | 0 | 0 |
| 56 | 0 | 0 | 0 | 0 | 0 |
| 57 | 0 | 0 | 0 | 0 | 0 |
| 58 | 0 | 0 | 0 | 0 | 1.5 |
| 59 | 0 | 0 | 0 | 0 | 0.75 |
| 60 | 0 | 0 | 0 | 0 | 0 |
| 61 | 0 | 0 | 0 | 0 | 0 |
| 62 | 0 | 0 | 0 | 0 | 0.5 |
| 63 | 0 | 0 | 0 | 0 | 0.5 |
| 64 | 0 | 0 | 0 | 0 | 0 |
| 65 | 0 | 0 | 0 | 0 | 1.5 |
| 66 | 0 | 0 | 0 | 0 | 0.5 |
| 67 | 0 | 0 | 0 | 0 | 1.0 |
| 68 | 0 | 0 | 0 | 0 | 0 |
| 69 | 0 | 0 | 0 | 0 | 0 |
| 70 | 0 | 0 | 0 | 0 | 1.0 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 2071 | 0 | 0 | 0 | 0 | 0 |
| 72 | 0 | 0 | 0 | 0 | 0 |
| 73 | 0 | 0 | 0 | 0 | 0 |
| 74 | 0 | 0 | 0 | 0 | 0.5 |
| 75 | 0 | 0 | 0 | 0 | 1.25 |
| 76 | 0 | 0 | 0 | 0 | 2.0 |
| 77 | 0 | 0 | 0 | 0 | 1.0 |
| 78 | 0 | 0 | 0 | 0 | 1.25 |
| 79 | 0 | 0 | 0 | 0 | 0.5 |
| 80 | 0 | 0 | 0 | 0 | 1.75 |
| 81 | 0 | 0 | 0 | 0 | 1.5 |
| 82 | 0 | 0 | 0 | 0 | 1.0 |
| 83 | 0 | 0 | 0 | 0 | 1.0 |
| 84 | 0 | 0 | 0 | 0 | 1.5 |
| 85 | 0 | 0 | 0 | 0 | 1.75 |
| 86 | 0 | 0 | 0 | 0 | 1.0 |
| 87 | 0 | 0 | 0 | 0 | 1.0 |
| 88 | 0 | 0 | 0 | 0 | 0.5 |
| 89 | 0 | 0 | 0 | 0 | 0 |
| 90 | 0 | 0 | 0 | 0 | 0 |
| 91 | 0 | 0 | 0 | 0 | 0 |
| 92 | 0 | 0 | 0 | 0 | 0 |
| 93 | 0 | 0 | 0 | 0 | 0 |
| 94 | 0 | 0 | 0 | 0 | 0 |
| 95 | 0 | 0 | 0 | 0 | 0 |
| 96 | 0 | 0 | 0 | 0 | 0.25 |
| 97 | 0 | 0 | 0 | 0 | 1.0 |
| 98 | 0 | 0 | 0 | 0 | 0.5 |
| 99 | 0 | 0 | 0 | 0 | 0.5 |
| 2100 | 0 | 0 | 0 | 0 | 2.0 |
| 101 | 0 | 0 | 0 | 0 | 1.0 |
| 102 | 0 | 0 | 0 | 0 | 0.25 |
| 103 | 0 | 0 | 0 | 0 | 1.0 |

| Grid No. | Height in meter Maximum | Height in meter Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 2104 | 0 | 0 | 0 | 0 | 0.25 |
| 105 | 0 | 0 | 0 | 0 | 0.5 |
| 106 | 20 | 20 | 0 | 0.8 | 0.5 |
| 107 | 20 | 20 | 0 | 1.3 | 1.5 |
| 108 | 20 | 20 | 0 | 0.8 | 0 |
| 109 | 0 | 0 | 0 | 0 | 0 |
| 110 | 20 | 20 | 0 | 0.4 | 1.5 |
| 111 | 20 | 20 | 0 | 0.4 | 0.5 |
| 112 | 0 | 0 | 0 | 0 | 0 |
| 113 | 0 | 0 | 0 | 0 | 0.5 |
| 114 | 0 | 0 | 0 | 0 | 0 |
| 115 | 0 | 0 | 0 | 0 | 0.5 |
| 116 | 0 | 0 | 0 | 0 | 0.5 |
| 117 | 0 | 0 | 0 | 0 | 0 |
| 118 | 20 | 20 | 0 | 0.4 | 0.5 |
| 119 | 20 | 20 | 0 | 0.4 | 1.25 |
| 120 | 0 | 0 | 0 | 0 | 0 |
| 121 | 0 | 0 | 0 | 0 | 0 |
| 122 | 20 | 20 | 0 | 1.1 | 1.5 |
| 123 | 20 | 20 | 0 | 0.8 | 0 |
| 124 | 0 | 0 | 0 | 0 | 1.0 |
| 125 | 0 | 0 | 0 | 0 | 0 |
| 126 | 0 | 0 | 0 | 0 | 0 |
| 127 | 0 | 0 | 0 | 0 | 0.25 |
| 128 | 0 | 0 | 0 | 0 | 1.0 |
| 129 | 0 | 0 | 0 | 0 | 0 |
| 130 | 0 | 0 | 0 | 0 | 0 |
| 131 | 0 | 0 | 0 | 0 | 0 |
| 132 | 0 | 0 | 0 | 0 | 1.5 |
| 133 | 0 | 0 | 0 | 0 | 1.5 |
| 134 | 0 | 0 | 0 | 0 | 0.5 |
| 135 | 0 | 0 | 0 | 0 | 0.5 |
| 136 | 0 | 0 | 0 | 0 | 0 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 2137 | 0 | 0 | 0 | 0 | 1.0 |
| 138 | 0 | 0 | 0 | 0 | 0 |
| 139 | 0 | 0 | 0 | 0 | 0 |
| 140 | 0 | 0 | 0 | 0 | 0 |
| 141 | 0 | 0 | 0 | 0 | 0 |
| 142 | 0 | 0 | 0 | 0 | 0.5 |
| 143 | 20 | 20 | 0 | 0.4 | 1.0 |
| 144 | 20 | 20 | 0 | 0.4 | 1.0 |
| 145 | 20 | 20 | 0 | 0.4 | 1.0 |
| 146 | 20 | 20 | 0 | 0.4 | 1.0 |
| 147 | 20 | 20 | 0 | 0.4 | 1.0 |
| 148 | 20 | 20 | 0 | 0.4 | 1.0 |
| 149 | 0 | 0 | 0 | 0 | 0 |
| 150 | 0 | 0 | 0 | 0 | 0 |
| 151 | 0 | 0 | 0 | 0 | 1.0 |
| 152 | 0 | 0 | 0 | 0 | 1.5 |
| 153 | 0 | 0 | 0 | 0 | 0.5 |
| 154 | 0 | 0 | 0 | 0 | 3.0 |
| 155 | 20 | 20 | 0 | 0.4 | 1.5 |
| 156 | 20 | 20 | 0 | 0.4 | 1.0 |
| 157 | 20 | 20 | 0 | 0.4 | 1.5 |
| 158 | 0 | 0 | 0 | 0 | 0.5 |
| 159 | 0 | 0 | 0 | 0 | 0.5 |
| 160 | 20 | 20 | 0 | 0.8 | 1.5 |
| 161 | 20 | 20 | 0 | 0.8 | 0.5 |
| 162 | 20 | 20 | 0 | 0.4 | 0 |
| 163 | 20 | 20 | 0 | 0.4 | 0 |
| 164 | 20 | 20 | 0 | 0.4 | 1.25 |
| 165 | 20 | 20 | 0 | 0.4 | 0 |
| 166 | 0 | 0 | 0 | 0 | 0 |
| 167 | 20 | 20 | 0 | 0.8 | 1.5 |
| 168 | 20 | 20 | 0 | 0.6 | 0.5 |

| Grid No. | Height in meter |  | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
|  | Maximum | Minimum |  |  |  |
| 2169 | 20 | 20 | 0 | 0.8 | 1.0 |
| 170 | 20 | 20 | 0 | 0.6 | 0.5 |
| 171 | 20 | 20 | 0 | 0.4 | 0.5 |
| 172 | 20 | 20 | 0 | 1.3 | 1.5 |
| 173 | 20 | 20 | 0 | 0.8 | 0.5 |
| 174 | 20 | 20 | 0 | 0 | 0 |
| 175 | 20 | 20 | 0 | 0.4 | 0 |
| 176 | 20 | 20 | 0 | 0.4 | 2.0 |
| 177 | 20 | 20 | 0 | 0.4 | 1.0 |
| 178 | 0 | 0 | 0 | 0 | 0 |
| 179 | 0 | 0 | 0 | 0 | 0 |
| 180 | 0 | 0 | 0 | 0 | 0 |
| 181 | 0 | 0 | 0 | 0 | 0.5 |
| 182 | 0 | 0 | 0 | 0 | 1.0 |
| 183 | 0 | 0 | 0 | 0 | 0 |
| 184 | 0 | 0 | 0 | 0 | 0 |
| 185 | 0 | 0 | 0 | 0 | 1.0 |
| 186 | 0 | 0 | 0 | 0 | 2.5 |
| 187 | 0 | 0 | 0 | 0 | 0.5 |
| 188 | 0 | 0 | 0 | 0 | 2.0 |
| 189 | 0 | 0 | 0 | 0 | 1.0 |
| 190 | 0 | 0 | 0 | 0 | 1.0 |
| 191 | 0 | 0 | 0 | 0 | 1.0 |
| 192 | 0 | 0 | 0 | 0 | 0 |
| 193 | 0 | 0 | 0 | 0 | 0 |
| 194 | 0 | 0 | 0 | 0 | 0 |
| 195 | 0 | 0 | 0 | 0 | 0 |
| 196 | 0 | 0 | 0 | 0 | 1.25 |
| 197 | 0 | 0 | 0 | 0 | 0 |
| 198 | 20 | 20 | 0 | 0.4 | 1.0 |
| 199 | 20 | 20 | 0 | 0.4 | 2.0 |
| 2200 | 20 | 20 | 0 | 0.4 | 1.5 |
| 201 | 20 | 20 | 0 | 0.4 | 1.0 |
| 202 | 20 | 20 | 0 | 0.4 | 1.0 |

| Grid No. | Height in meter | | Relative relief | Slope in degree | Drainage density |
|---|---|---|---|---|---|
| | Maximum | Minimum | | | |
| 2203 | 20 | 20 | 0 | 0 | 0 |
| 204 | 20 | 20 | 0 | 0.4 | 2.0 |
| 205 | 20 | 20 | 0 | 0.4 | 2.0 |
| 206 | 20 | 20 | 0 | 0.4 | 1.0 |
| 207 | 20 | 20 | 0 | 0.4 | 2.0 |
| 208 | 0 | 0 | 0 | 0 | 1.0 |
| 209 | 0 | 0 | 0 | 0.8 | 0.5 |
| 210 | 0 | 0 | 0 | 0 | 0 |
| 211 | 20 | 20 | 0 | 0.4 | 0 |
| 212 | 20 | 20 | 0 | 0.8 | 0 |
| 213 | 20 | 20 | 0 | 0.4 | 1.0 |
| 214 | 20 | 20 | 0 | 0.4 | 0 |
| 215 | 20 | 20 | 0 | 0.8 | 0 |
| 216 | 20 | 20 | 0 | 0.4 | 1.5 |
| 217 | 20 | 20 | 0 | 0.6 | 1.5 |
| 218 | 0 | 0 | 0 | 0 | 0 |
| 219 | 20 | 20 | 0 | 0.4 | 1.0 |
| 220 | 20 | 20 | 0 | 0.8 | 2.0 |
| 221 | 20 | 20 | 0 | 1.3 | 0.5 |
| 222 | 20 | 20 | 0 | 0.8 | 0.5 |
| 223 | 20 | 20 | 0 | 1.3 | 1.0 |
| 224 | 20 | 20 | 0 | 0.8 | 0 |
| 225 | 20 | 20 | 0 | 0.4 | 0 |
| 226 | 20 | 20 | 0 | 0 | 0 |
| 227 | 20 | 20 | 0 | 0.4 | 1.5 |
| 228 | 20 | 20 | 0 | 0.8 | 1.5 |
| 229 | 20 | 20 | 0 | 0.4 | 0 |
| 230 | 0 | 0 | 0 | 0 | 0 |
| 231 | 0 | 0 | 0 | 0 | 0 |
| 232 | 0 | 0 | 0 | 0 | 0 |
| 233 | 0 | 0 | 0 | 0 | 1.0 |
| 234 | 0 | 0 | 0 | 0 | 0.25 |
| 235 | 0 | 0 | 0 | 0 | 0 |

| Grid No. | Height in meter | | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| | Maximum | Minimum | | | |
| 2236 | 0 | 0 | 0 | 0 | 0 |
| 237 | 0 | 0 | 0 | 0 | 1.75 |
| 238 | 0 | 0 | 0 | 0 | 0.5 |
| 239 | 0 | 0 | 0 | 0 | 0 |
| 240 | 0 | 0 | 0 | 0 | 1.0 |
| 241 | 0 | 0 | 0 | 0 | 1.0 |
| 242 | 0 | 0 | 0 | 0 | 1.5 |
| 243 | 0 | 0 | 0 | 0 | 0.25 |
| 244 | 0 | 0 | 0 | 0 | 0 |
| 245 | 0 | 0 | 0 | 0 | 0 |
| 246 | 0 | 0 | 0 | 0 | 0 |
| 247 | 0 | 0 | 0 | 0 | 0 |
| 248 | 0 | 0 | 0 | 0 | 1.0 |
| 249 | 0 | 0 | 0 | 0.4 | 0.75 |
| 250 | 0 | 0 | 0 | 0.4 | 1.5 |
| 251 | 0 | 0 | 0 | 0 | 0 |
| 252 | 0 | 0 | 0 | 0 | 0.5 |
| 253 | 0 | 0 | 0 | 0 | 1.0 |
| 254 | 0 | 0 | 0 | 0 | 1.0 |
| 255 | 0 | 0 | 0 | 0 | 0 |
| 256 | 20 | 20 | 0 | 0.4 | 1.5 |
| 257 | 20 | 20 | 0 | 0.8 | 2.0 |
| 258 | 20 | 20 | 0 | 0.4 | 0 |
| 259 | 20 | 20 | 0 | 0.4 | 0 |
| 260 | 0 | 0 | 0 | 0 | 2.0 |
| 261 | 0 | 0 | 0 | 0 | 1.5 |
| 262 | 20 | 20 | 0 | 0.4 | 0 |
| 263 | 20 | 20 | 0 | 0.4 | 0 |
| 264 | 20 | 20 | 0 | 0.8 | 0 |
| 265 | 20 | 20 | 0 | 0.4 | 0 |
| 266 | 0 | 0 | 0 | 0 | 1.0 |
| 267 | 20 | 20 | 0 | 0.4 | 0 |
| 268 | 20 | 20 | 0 | 0.8 | 0.25 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 2269 | 20 | 20 | 0 | 0.4 | 2.0 |
| 270 | 20 | 20 | 0 | 0.8 | 0 |
| 271 | 20 | 20 | 0 | 0.4 | 0 |
| 272 | 20 | 20 | 0 | 0.8 | 0 |
| 273 | 20 | 20 | 0 | 0.8 | 1.0 |
| 274 | 20 | 20 | 0 | 0.8 | 1.5 |
| 275 | 20 | 20 | 0 | 0.4 | 2.0 |
| 276 | 20 | 20 | 0 | 0.4 | 0.5 |
| 277 | 20 | 20 | 0 | 0.8 | 0.25 |
| 278 | 20 | 20 | 0 | 1.1 | 0.25 |
| 279 | 20 | 20 | 0 | 0.4 | 0.5 |
| 280 | 20 | 20 | 0 | 0.4 | 3.0 |
| 281 | 20 | 20 | 0 | 0.8 | 1.5 |
| 282 | 0 | 0 | 0 | 0 | 0.5 |
| 283 | 0 | 0 | 0 | 0 | 0 |
| 284 | 0 | 0 | 0 | 0 | 0 |
| 285 | 0 | 0 | 0 | 0 | 0 |
| 286 | 0 | 0 | 0 | 0 | 0.5 |
| 287 | 0 | 0 | 0 | 0 | 0.75 |
| 288 | 0 | 0 | 0 | 0 | 0 |
| 289 | 0 | 0 | 0 | 0 | 2.0 |
| 290 | 0 | 0 | 0 | 0 | 1.0 |
| 291 | 0 | 0 | 0 | 0 | 0.75 |
| 292 | 0 | 0 | 0 | 0 | 0.25 |
| 293 | 0 | 0 | 0 | 0 | 1.5 |
| 294 | 0 | 0 | 0 | 0 | 0 |
| 295 | 0 | 0 | 0 | 0 | 0 |
| 296 | 0 | 0 | 0 | 0 | 0 |
| 297 | 0 | 0 | 0 | 0 | 0 |
| 298 | 0 | 0 | 0 | 0 | 1.0 |
| 299 | 0 | 0 | 0 | 0 | 0 |
| 2300 | 0 | 0 | 0 | 0 | 0 |
| 301 | 15 | 15 | 0 | 0.4 | 0 |
| 302 | 15 | 15 | 0 | 0.4 | 1.0 |

| Grid No. | Height in meter Maximum x | Minimum | Relative relief | Slope in degree | Drainage density |
|---|---|---|---|---|---|
| 2303 | 0 | 0 | 0 | 0 | 1.0 |
| 304 | 0 | 0 | 0 | 0 | 0 |
| 305 | 0 | 0 | 0 | 0 | 0 |
| 306 | 15 | 15 | 0 | 0.4 | 1.0 |
| 307 | 15 | 15 | 0 | 0.4 | 2.0 |
| 308 | 0 | 0 | 0 | 0 | 1.0 |
| 309 | 0 | 0 | 0 | 0 | 0.25 |
| 310 | 0 | 0 | 0 | 0 | 1.0 |
| 311 | 15 | 15 | 0 | 0.4 | 1.0 |
| 312 | 15 | 15 | 0 | 0.4 | 0 |
| 313 | 15 | 15 | 0 | 0.4 | 0 |
| 314 | 15 | 15 | 0 | 0.4 | 0 |
| 315 | 0 | 0 | 0 | 0 | 1.0 |
| 316 | 0 | 0 | 0 | 0 | 2.0 |
| 317 | 15 | 15 | 0 | 0.4 | 0.5 |
| 318 | 15 | 15 | 0 | 0.4 | 1.0 |
| 319 | 15 | 15 | 0 | 1.5 | 0.25 |
| 320 | 15 | 15 | 0 | 1.9 | 0 |
| 321 | 15 | 15 | 0 | 0.4 | 0 |
| 322 | 15 | 15 | 0 | 0.4 | 0.75 |
| 323 | 15 | 15 | 0 | 0.4 | 0 |
| 324 | 0 | 0 | 0 | 0 | 3.0 |
| 325 | 0 | 0 | 0 | 0 | 2.5 |
| 326 | 15 | 15 | 0 | 0.4 | 1.5 |
| 327 | 15 | 15 | 0 | 0.4 | 3.0 |
| 328 | 15 | 15 | 0 | 0.4 | 3.0 |
| 329 | 15 | 15 | 0 | 0.8 | 2.5 |
| 330 | 15 | 15 | 0 | 0.8 | 1.5 |
| 331 | 15 | 15 | 0 | 0.4 | 0 |
| 332 | 0 | 0 | 0 | 0 | 0 |
| 333 | 0 | 0 | 0 | 0 | 0 |
| 334 | 0 | 0 | 0 | 0 | 0 |
| 335 | 0 | 0 | 0 | 0 | 0 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 2336 | 0 | 0 | 0 | 0 | 0 |
| 337 | 0 | 0 | 0 | 0 | 1.5 |
| 338 | 0 | 0 | 0 | 0 | 0 |
| 339 | 0 | 0 | 0 | 0 | 1.25 |
| 340 | 0 | 0 | 0 | 0 | 1.5 |
| 341 | 0 | 0 | 0 | 0 | 0.5 |
| 342 | 0 | 0 | 0 | 0 | 1.0 |
| 343 | 0 | 0 | 0 | 0 | 1.0 |
| 344 | 0 | 0 | 0 | 0 | 1.0 |
| 345 | 0 | 0 | 0 | 0 | 0 |
| 346 | 0 | 0 | 0 | 0 | 0 |
| 347 | 0 | 0 | 0 | 0 | 0 |
| 348 | 0 | 0 | 0 | 0 | 1.0 |
| 349 | 0 | 0 | 0 | 0 | 0 |
| 350 | 15 | 15 | 0 | 0.4 | 0.25 |
| 351 | 15 | 15 | 0 | 1.3 | 1.0 |
| 352 | 15 | 15 | 0 | 0.8 | 0.5 |
| 353 | 0 | 0 | 0 | 0 | 0 |
| 354 | 0 | 0 | 0 | 0 | 0 |
| 355 | 15 | 15 | 0 | 0.4 | 0.25 |
| 356 | 0 | 0 | 0 | 0 | 2.0 |
| 357 | 0 | 0 | 0 | 0 | 2.5 |
| 358 | 0 | 0 | 0 | 0 | 2.5 |
| 359 | 0 | 0 | 0 | 0 | 2.0 |
| 360 | 0 | 0 | 0 | 0 | 2.0 |
| 361 | 15 | 15 | 0 | 0.4 | 0.5 |
| 362 | 0 | 0 | 0 | 0 | 0 |
| 363 | 0 | 0 | 0 | 0 | 0 |
| 364 | 0 | 0 | 0 | 0 | 0 |
| 365 | 0 | 0 | 0 | 0 | 0 |
| 366 | 0 | 0 | 0 | 0 | 0.5 |
| 367 | 0 | 0 | 0 | 0 | 1.5 |
| 368 | 0 | 0 | 0 | 0 | 1.0 |
| 369 | 15 | 15 | 0 | 0.4 | 0 |
| 370 | 15 | 15 | 0 | 0.4 | 0 |
| 371 | 0 | 0 | 0 | 0 | 1.0 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 2372 | 0 | 0 | 0 | 0 | 3.5 |
| 373 | 0 | 0 | 0 | 0 | 2.5 |
| 374 | 15 | 15 | 0 | 0.8 | 0 |
| 375 | 15 | 15 | 0 | 1.3 | 0 |
| 376 | 15 | 15 | 0 | 1.1 | 0 |
| 377 | 15 | 15 | 0 | 0.4 | 0 |
| 378 | 15 | 15 | 0 | 0.4 | 0 |
| 379 | 15 | 15 | 0 | 1.1 | 0 |
| 380 | 15 | 15 | 0 | 0.4 | 0 |
| 381 | 15 | 15 | 0 | 0.4 | 0 |
| 382 | 0 | 0 | 0 | 0 | 0 |
| 383 | 0 | 0 | 0 | 0 | 0 |
| 384 | 0 | 0 | 0 | 0 | 0 |
| 385 | 0 | 0 | 0 | 0 | 0 |
| 386 | 0 | 0 | 0 | 0 | 1.0 |
| 387 | 0 | 0 | 0 | 0 | 0 |
| 388 | 0 | 0 | 0 | 0 | 1.0 |
| 389 | 0 | 0 | 0 | 0 | 1.0 |
| 390 | 0 | 0 | 0 | 0 | 0.5 |
| 391 | 0 | 0 | 0 | 0 | 0.5 |
| 392 | 0 | 0 | 0 | 0 | 0 |
| 393 | 0 | 0 | 0 | 0 | 1.0 |
| 394 | 0 | 0 | 0 | 0 | 0.75 |
| 395 | 0 | 0 | 0 | 0 | 0 |
| 396 | 0 | 0 | 0 | 0 | 0 |
| 397 | 0 | 0 | 0 | 0 | 1.0 |
| 398 | 0 | 0 | 0 | 0 | 0 |
| 399 | 15 | 15 | 0 | 0.8 | 0 |
| 2400 | 15 | 15 | 0 | 1.3 | 0 |
| 401 | 15 | 15 | 0 | 0.4 | 0.5 |
| 402 | 0 | 0 | 0 | 0 | 0.5 |
| 403 | 15 | 15 | 0 | 1.3 | 0 |
| 404 | 0 | 0 | 0 | 0 | 0.5 |

| Grid No. | Height in meter | | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| | Maximum | Minimum | | | |
| 2405 | 0 | 0 | 0 | 0 | 1.5 |
| 406 | 0 | 0 | 0 | 0 | 1.5 |
| 407 | 0 | 0 | 0 | 0 | 1.0 |
| 408 | 0 | 0 | 0 | 0 | 1.0 |
| 409 | 0 | 0 | 0 | 0 | 0 |
| 410 | 0 | 0 | 0 | 0 | 0 |
| 411 | 0 | 0 | 0 | 0 | 0 |
| 412 | 0 | 0 | 0 | 0 | 0 |
| 413 | 0 | 0 | 0 | 0 | 1.0 |
| 414 | 0 | 0 | 0 | 0 | 0 |
| 415 | 0 | 0 | 0 | 0 | 2.0 |
| 416 | 0 | 0 | 0 | 0 | 2.0 |
| 417 | 0 | 0 | 0 | 0 | 0 |
| 418 | 0 | 0 | 0 | 0 | 0 |
| 419 | 0 | 0 | 0 | 0 | 0 |
| 420 | 0 | 0 | 0 | 0 | 2.5 |
| 421 | 0 | 0 | 0 | 0 | 0.25 |
| 422 | 15 | 15 | 0 | 0.4 | 0 |
| 423 | 15 | 15 | 0 | 0.8 | 0 |
| 424 | 15 | 15 | 0 | 0.8 | 0 |
| 425 | 15 | 15 | 0 | 0.4 | 0 |
| 426 | 15 | 15 | 0 | 0.4 | 0 |
| 427 | 15 | 15 | 0 | 0.4 | 0 |
| 428 | 0 | 0 | 0 | 0 | 0 |
| 429 | 15 | 15 | 0 | 0.4 | 0 |
| 430 | 15 | 15 | 0 | 0.4 | 0 |
| 431 | 15 | 15 | 0 | 0.4 | 0 |
| 432 | 15 | 15 | 0 | 0.4 | 0 |
| 433 | 0 | 0 | 0 | 0 | 1.0 |
| 434 | 0 | 0 | 0 | 0 | 1.5 |
| 435 | 0 | 0 | 0 | 0 | 2.0 |
| 436 | 0 | 0 | 0 | 0 | 1.0 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 2437 | 0 | 0 | 0 | 0 | 1.0 |
| 438 | 0 | 0 | 0 | 0 | 1.25 |
| 439 | 0 | 0 | 0 | 0 | 1.0 |
| 440 | 0 | 0 | 0 | 0 | 1.0 |
| 441 | 0 | 0 | 0 | 0 | 1.25 |
| 442 | 0 | 0 | 0 | 0 | 0.5 |
| 443 | 0 | 0 | 0 | 0 | 0 |
| 444 | 0 | 0 | 0 | 0 | 0 |
| 445 | 0 | 0 | 0 | 0 | 1.0 |
| 446 | 0 | 0 | 0 | 0 | 0.5 |
| 447 | 15 | 15 | 0 | 0.8 | 0 |
| 448 | 15 | 15 | 0 | 0.8 | 0 |
| 449 | 15 | 15 | 0 | 0.4 | 0 |
| 450 | 15 | 15 | 0 | 0 | 0 |
| 451 | 15 | 15 | 0 | 0.4 | 0 |
| 452 | 15 | 15 | 0 | 0.4 | 0 |
| 453 | 0 | 0 | 0 | 0 | 0 |
| 454 | 0 | 0 | 0 | 0 | 0 |
| 455 | 0 | 0 | 0 | 0 | 0 |
| 456 | 0 | 0 | 0 | 0 | 0 |
| 457 | 0 | 0 | 0 | 0 | 1.0 |
| 458 | 0 | 0 | 0 | 0 | 1.0 |
| 459 | 0 | 0 | 0 | 0 | 0.5 |
| 460 | 0 | 0 | 0 | 0 | 0.5 |
| 461 | 0 | 0 | 0 | 0 | 1.0 |
| 462 | 0 | 0 | 0 | 0 | 1.0 |
| 463 | 0 | 0 | 0 | 0 | 0.5 |
| 464 | 0 | 0 | 0 | 0 | 0.5 |
| 465 | 0 | 0 | 0 | 0 | 0 |
| 466 | 0 | 0 | 0 | 0 | 0 |
| 467 | 0 | 0 | 0 | 0 | 0 |
| 468 | 0 | 0 | 0 | 0 | 2.5 |
| 469 | 0 | 0 | 0 | 0 | 3.0 |
| 470 | 0 | 0 | 0 | 0 | 1.25 |

| Grid No. | Height in meter | | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| | Maximum | Minimum | | | |
| 2471 | 0 | 0 | 0 | 0 | 0.25 |
| 472 | 15 | 15 | 0 | 0.4 | 0 |
| 473 | 15 | 15 | 0 | 0.8 | 0 |
| 474 | 15 | 15 | 0 | 0.4 | 0 |
| 475 | 0 | 0 | 0 | 0 | 0 |
| 476 | 0 | 0 | 0 | 0 | 0 |
| 477 | 0 | 0 | 0 | 0 | 1.5 |
| 478 | 0 | 0 | 0 | 0 | 0.5 |
| 479 | 0 | 0 | 0 | 0 | 0.5 |
| 480 | 0 | 0 | 0 | 0 | 0.5 |
| 481 | 15 | 15 | 0 | 0.8 | 0 |
| 482 | 15 | 15 | 0 | 0.6 | 1.0 |
| 483 | 0 | 0 | 0 | 0 | 0.25 |
| 484 | 0 | 0 | 0 | 0 | 1.5 |
| 485 | 0 | 0 | 0 | 0 | 0.5 |
| 486 | 0 | 0 | 0 | 0 | 1.0 |
| 487 | 0 | 0 | 0 | 0 | 1.0 |
| 488 | 0 | 0 | 0 | 0 | 1.5 |
| 489 | 0 | 0 | 0 | 0 | 0.5 |
| 490 | 0 | 0 | 0 | 0 | 0 |
| 491 | 0 | 0 | 0 | 0 | 0.5 |
| 492 | 0 | 0 | 0 | 0 | 0.5 |
| 493 | 0 | 0 | 0 | 0 | 0.25 |
| 494 | 15 | 15 | 0 | 0.4 | 0 |
| 495 | 15 | 15 | 0 | 0.8 | 1.25 |
| 496 | 15 | 15 | 0 | 1.1 | 0 |
| 497 | 0 | 0 | 0 | 0 | 0 |
| 498 | 0 | 0 | 0 | 0 | 0 |
| 499 | 0 | 0 | 0 | 0 | 0 |
| 2500 | 0 | 0 | 0 | 0 | 0 |
| 501 | 0 | 0 | 0 | 0 | 0 |
| 502 | 0 | 0 | 0 | 0 | 0 |
| 503 | 0 | 0 | 0 | 0 | 0 |

| Grid No. | Height in meter | | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| | Maximum | Minimum | | | |
| 2504 | 0 | 0 | 0 | 0 | 0 |
| 506 | 0 | 0 | 0 | 0 | 1.0 |
| 506 | 0 | 0 | 0 | 0 | 1.5 |
| 507 | 0 | 0 | 0 | 0 | 0.5 |
| 508 | 0 | 0 | 0 | 0 | 0 |
| 509 | 0 | 0 | 0 | 0 | 0 |
| 510 | 0 | 0 | 0 | 0 | 0.5 |
| 511 | 0 | 0 | 0 | 0 | 1.5 |
| 512 | 0 | 0 | 0 | 0 | 2.0 |
| 513 | 0 | 0 | 0 | 0 | 0.5 |
| 514 | 0 | 0 | 0 | 0 | 0 |
| 515 | 0 | 0 | 0 | 0 | 0.5 |
| 516 | 0 | 0 | 0 | 0 | 1.25 |
| 517 | 0 | 0 | 0 | 0 | 4.0 |
| 518 | 0 | 0 | 0 | 0 | 1.0 |
| 519 | 0 | 0 | 0 | 0 | 0 |
| 520 | 0 | 0 | 0 | 0 | 0 |
| 521 | 0 | 0 | 0 | 0 | 0 |
| 522 | 0 | 0 | 0 | 0 | 1.0 |
| 523 | 0 | 0 | 0 | 0 | 0 |
| 524 | 0 | 0 | 0 | 0 | 0 |
| 525 | 0 | 0 | 0 | 0 | 0.5 |
| 526 | 0 | 0 | 0 | 0 | 1.0 |
| 527 | 0 | 0 | 0 | 0 | 0 |
| 528 | 0 | 0 | 0 | 0 | 1.0 |
| 529 | 0 | 0 | 0 | 0 | 0 |
| 530 | 10 | 10 | 0 | 0.6 | 0.5 |
| 531 | 10 | 10 | 0 | 0.8 | 1.25 |
| 532 | 10 | 10 | 0 | 0.4 | 0.25 |
| 533 | 10 | 10 | 0 | 0 | 1.0 |
| 534 | 10 | 10 | 0 | 0.4 | 0.5 |
| 535 | 10 | 10 | 0 | 0.4 | 0.5 |
| 536 | 10 | 10 | 0 | 0.4 | 1.25 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 2537 | 10 | 10 | 0 | 0.4 | 1.5 |
| 538 | 10 | 10 | 0 | 0.4 | 0 |
| 539 | 10 | 10 | 0 | 0.4 | 0.25 |
| 540 | 10 | 10 | 0 | 0.4 | 1.0 |
| 541 | 10 | 10 | 0 | 0.4 | 0 |
| 542 | 10 | 10 | 0 | 0.4 | 0 |
| 543 | 10 | 10 | 0 | 0.8 | 0 |
| 544 | 10 | 10 | 0 | 0.4 | 0.5 |
| 545 | 10 | 10 | 0 | 0.4 | 1.25 |
| 546 | 0 | 0 | 0 | 0 | 1.5 |
| 547 | 0 | 0 | 0 | 0 | 1.5 |
| 548 | 0 | 0 | 0 | 0 | 1.5 |
| 549 | 0 | 0 | 0 | 0 | 2.0 |
| 550 | 0 | 0 | 0 | 0 | 1.0 |
| 551 | 0 | 0 | 0 | 0 | 0.5 |
| 552 | 0 | 0 | 0 | 0 | 0.5 |
| 553 | 0 | 0 | 0 | 0 | 1.0 |
| 554 | 0 | 0 | 0 | 0 | 0.75 |
| 555 | 0 | 0 | 0 | 0 | 0.5 |
| 556 | 0 | 0 | 0 | 0 | 0 |
| 557 | 0 | 0 | 0 | 0 | 0 |
| 558 | 0 | 0 | 0 | 0 | 0 |
| 559 | 0 | 0 | 0 | 0 | 0 |
| 560 | 0 | 0 | 0 | 0 | 1.0 |
| 561 | 0 | 0 | 0 | 0 | 0 |
| 562 | 0 | 0 | 0 | 0 | 0.5 |
| 563 | 0 | 0 | 0 | 0 | 2.5 |
| 564 | 0 | 0 | 0 | 0 | 2.5 |
| 565 | 0 | 0 | 0 | 0 | 0.5 |
| 566 | 0 | 0 | 0 | 0 | 0.25 |
| 567 | 0 | 0 | 0 | 0 | 0 |
| 568 | 0 | 0 | 0 | 0 | 1.25 |
| 569 | 0 | 0 | 0 | 0 | 0.5 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 2570 | 0 | 0 | 0 | 0 | 0.25 |
| 571 | 0 | 0 | 0 | 0 | 0.25 |
| 572 | 0 | 0 | 0 | 0 | 2.0 |
| 573 | 0 | 0 | 0 | 0 | 0 |
| 574 | 0 | 0 | 0 | 0 | 0 |
| 575 | 0 | 0 | 0 | 0 | 1.0 |
| 576 | 0 | 0 | 0 | 0 | 2.5 |
| 577 | 0 | 0 | 0 | 0 | 1.5 |
| 578 | 10 | 10 | 0 | 1.1 | 0.5 |
| 579 | 10 | 10 | 0 | 1.3 | 1.5 |
| 580 | 10 | 10 | 0 | 0.4 | 0.5 |
| 581 | 10 | 10 | 0 | 0.4 | 1.0 |
| 582 | 10 | 10 | 0 | 0.4 | 0.25 |
| 583 | 10 | 10 | 0 | 0.4 | 1.25 |
| 584 | 10 | 10 | 0 | 0.4 | 1.0 |
| 585 | 10 | 10 | 0 | 0.4 | 0 |
| 586 | 10 | 10 | 0 | 0.4 | 1.0 |
| 587 | 10 | 10 | 0 | 0.4 | 0.25 |
| 588 | 10 | 10 | 0 | 0.4 | 0 |
| 589 | 10 | 10 | 0 | 0.4 | 0 |
| 590 | 10 | 10 | 0 | 0.8 | 0 |
| 591 | 10 | 10 | 0 | 0.4 | 0 |
| 592 | 10 | 10 | 0 | 0.4 | 0 |
| 593 | 0 | 0 | 0 | 0 | 2.0 |
| 594 | 0 | 0 | 0 | 0 | 1.0 |
| 595 | 0 | 0 | 0 | 0 | 1.0 |
| 596 | 0 | 0 | 0 | 0 | 0.5 |
| 597 | 0 | 0 | 0 | 0 | 0.5 |
| 598 | 0 | 0 | 0 | 0 | 1.0 |
| 599 | 0 | 0 | 0 | 0 | 1.0 |
| 2600 | 0 | 0 | 0 | 0 | 0.5 |
| 601 | 0 | 0 | 0 | 0 | 0.5 |
| 602 | 0 | 0 | 0 | 0 | 2.0 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 2603 | 0 | 0 | 0 | 0 | 1.0 |
| 604 | 0 | 0 | 0 | 0 | 0 |
| 605 | 0 | 0 | 0 | 0 | 0.5 |
| 606 | 0 | 0 | 0 | 0 | 1.25 |
| 607 | 0 | 0 | 0 | 0 | 1.5 |
| 608 | 0 | 0 | 0 | 0 | 3.0 |
| 609 | 0 | 0 | 0 | 0 | 1.5 |
| 610 | 0 | 0 | 0 | 0 | 1.5 |
| 611 | 0 | 0 | 0 | 0 | 1.25 |
| 612 | 0 | 0 | 0 | 0 | 0.25 |
| 613 | 0 | 0 | 0 | 0 | 1.0 |
| 614 | 0 | 0 | 0 | 0 | 0 |
| 615 | 0 | 0 | 0 | 0 | 1.25 |
| 616 | 0 | 0 | 0 | 0 | 0 |
| 617 | 0 | 0 | 0 | 0 | 0 |
| 618 | 0 | 0 | 0 | 0 | 0.5 |
| 619 | 0 | 0 | 0 | 0 | 1.5 |
| 620 | 0 | 0 | 0 | 0 | 0 |
| 621 | 10 | 10 | 0 | 0.8 | 0 |
| 622 | 10 | 10 | 0 | 1.3 | 0.5 |
| 623 | 10 | 10 | 0 | 0.8 | 0.5 |
| 624 | 10 | 10 | 0 | 0.4 | 1.0 |
| 625 | 0 | 0 | 0 | 0 | 1.25 |
| 626 | 0 | 0 | 0 | 0 | 1.0 |
| 627 | 0 | 0 | 0 | 0 | 0.5 |
| 628 | 0 | 0 | 0 | 0 | 2.0 |
| 629 | 0 | 0 | 0 | 0 | 0.5 |
| 630 | 0 | 0 | 0 | 0 | 1.5 |
| 631 | 0 | 0 | 0 | 0 | 1.0 |
| 632 | 0 | 0 | 0 | 0 | 0.5 |
| 633 | 0 | 0 | 0 | 0 | 0.75 |
| 634 | 0 | 0 | 0 | 0 | 1.0 |
| 635 | 0 | 0 | 0 | 0 | 1.0 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 2636 | 0 | 0 | 0 | 0 | 0.75 |
| 637 | 0 | 0 | 0 | 0 | 1.0 |
| 638 | 0 | 0 | 0 | 0 | 1.25 |
| 639 | 0 | 0 | 0 | 0 | 2.0 |
| 640 | 0 | 0 | 0 | 0 | 2.0 |
| 641 | 0 | 0 | 0 | 0 | 1.0 |
| 642 | 0 | 0 | 0 | 0 | 0 |
| 643 | 0 | 0 | 0 | 0 | 0.25 |
| 644 | 0 | 0 | 0 | 0 | 1.5 |
| 645 | 0 | 0 | 0 | 0 | 2.5 |
| 646 | 0 | 0 | 0 | 0 | 2.0 |
| 647 | 0 | 0 | 0 | 0 | 0.5 |
| 648 | 0 | 0 | 0 | 0 | 0 |
| 649 | 0 | 0 | 0 | 0 | 1.25 |
| 650 | 0 | 0 | 0 | 0 | 0 |
| 651 | 0 | 0 | 0 | 0 | 1.75 |
| 652 | 0 | 0 | 0 | 0 | 0.5 |
| 653 | 0 | 0 | 0 | 0 | 0.25 |
| 654 | 0 | 0 | 0 | 0 | 1.5 |
| 655 | 0 | 0 | 0 | 0 | 0.25 |
| 656 | 0 | 0 | 0 | 0 | 0 |
| 657 | 0 | 0 | 0 | 0 | 0 |
| 658 | 0 | 0 | 0 | 0 | 0 |
| 659 | 0 | 0 | 0 | 0 | 1.0 |
| 660 | 0 | 0 | 0 | 0 | 0 |
| 661 | 0 | 0 | 0 | 0 | 1.0 |
| 662 | 0 | 0 | 0 | 0 | 2.0 |
| 663 | 0 | 0 | 0 | 0 | 0 |
| 664 | 0 | 0 | 0 | 0 | 1.0 |
| 665 | 0 | 0 | 0 | 0 | 0 |
| 666 | 0 | 0 | 0 | 0 | 0 |
| 667 | 0 | 0 | 0 | 0 | 1.0 |
| 668 | 0 | 0 | 0 | 0 | 1.0 |
| 669 | 0 | 0 | 0 | 0 | 1.0 |
| 670 | 0 | 0 | 0 | 0 | 1.0 |
| 671 | 0 | 0 | 0 | 0 | 0.5 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 2672 | 0 | 0 | 0 | 0 | 1.0 |
| 673 | 0 | 0 | 0 | 0 | 1.0 |
| 674 | 0 | 0 | 0 | 0 | 0.5 |
| 675 | 0 | 0 | 0 | 0 | 1.5 |
| 676 | 0 | 0 | 0 | 0 | 1.0 |
| 677 | 0 | 0 | 0 | 0 | 1.0 |
| 678 | 0 | 0 | 0 | 0 | 1.0 |
| 679 | 0 | 0 | 0 | 0 | 0 |
| 680 | 0 | 0 | 0 | 0 | 0.5 |
| 681 | 0 | 0 | 0 | 0 | 2.0 |
| 682 | 0 | 0 | 0 | 0 | 3.0 |
| 683 | 0 | 0 | 0 | 0 | 1.0 |
| 684 | 0 | 0 | 0 | 0 | 2.0 |
| 685 | 0 | 0 | 0 | 0 | 1.5 |
| 686 | 0 | 0 | 0 | 0 | 0.75 |
| 687 | 0 | 0 | 0 | 0 | 0.75 |
| 688 | 0 | 0 | 0 | 0 | 1.0 |
| 689 | 0 | 0 | 0 | 0 | 0.75 |
| 690 | 0 | 0 | 0 | 0 | 0 |
| 691 | 0 | 0 | 0 | 0 | 0 |
| 692 | 0 | 0 | 0 | 0 | 0 |
| 693 | 0 | 0 | 0 | 0 | 0 |
| 694 | 0 | 0 | 0 | 0 | 0.5 |
| 695 | 0 | 0 | 0 | 0 | 1.5 |
| 696 | 0 | 0 | 0 | 0 | 1.5 |
| 697 | 0 | 0 | 0 | 0 | 1.75 |
| 698 | 0 | 0 | 0 | 0 | 0 |
| 699 | 0 | 0 | 0 | 0 | 0.75 |
| 2700 | 0 | 0 | 0 | 0 | 1.0 |
| 701 | 0 | 0 | 0 | 0 | 0 |
| 702 | 0 | 0 | 0 | 0 | 0 |
| 703 | 0 | 0 | 0 | 0 | 0 |
| 704 | 0 | 0 | 0 | 0 | 1.0 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 2705 | 0 | 0 | 0 | 0 | 1.0 |
| 706 | 0 | 0 | 0 | 0 | 0.5 |
| 707 | 0 | 0 | 0 | 0 | 0 |
| 708 | 0 | 0 | 0 | 0 | 0 |
| 709 | 0 | 0 | 0 | 0 | 0.25 |
| 710 | 0 | 0 | 0 | 0 | 0.5 |
| 711 | 0 | 0 | 0 | 0 | 1.0 |
| 712 | 0 | 0 | 0 | 0 | 0.5 |
| 713 | 0 | 0 | 0 | 0 | 0 |
| 714 | 0 | 0 | 0 | 0 | 0 |
| 715 | 0 | 0 | 0 | 0 | 0 |
| 716 | 0 | 0 | 0 | 0 | 0.5 |
| 717 | 0 | 0 | 0 | 0 | 1.25 |
| 718 | 0 | 0 | 0 | 0 | 1.0 |
| 719 | 0 | 0 | 0 | 0 | 2.5 |
| 720 | 0 | 0 | 0 | 0 | 0 |
| 721 | 0 | 0 | 0 | 0 | 0 |
| 722 | 0 | 0 | 0 | 0 | 1.0 |
| 723 | 0 | 0 | 0 | 0 | 0.5 |
| 724 | 0 | 0 | 0 | 0 | 0 |
| 725 | 0 | 0 | 0 | 0 | 0 |
| 726 | 0 | 0 | 0 | 0 | 1.0 |
| 727 | 0 | 0 | 0 | 0 | 0 |
| 728 | 0 | 0 | 0 | 0 | 0 |
| 729 | 0 | 0 | 0 | 0 | 1.25 |
| 730 | 0 | 0 | 0 | 0 | 1.75 |
| 731 | 0 | 0 | 0 | 0 | 1.25 |
| 732 | 0 | 0 | 0 | 0 | 1.25 |
| 733 | 0 | 0 | 0 | 0 | 1.5 |
| 734 | 0 | 0 | 0 | 0 | 2.0 |
| 735 | 0 | 0 | 0 | 0 | 1.5 |
| 736 | 0 | 0 | 0 | 0 | 0 |
| 737 | 0 | 0 | 0 | 0 | 0 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 2738 | 0 | 0 | 0 | 0 | 0 |
| 739 | 0 | 0 | 0 | 0 | 0 |
| 740 | 0 | 0 | 0 | 0 | 0 |
| 741 | 0 | 0 | 0 | 0 | 0 |
| 742 | 0 | 0 | 0 | 0 | 0 |
| 743 | 0 | 0 | 0 | 0 | 0 |
| 744 | 0 | 0 | 0 | 0 | 0 |
| 745 | 0 | 0 | 0 | 0 | 0 |
| 746 | 0 | 0 | 0 | 0 | 0 |
| 747 | 0 | 0 | 0 | 0 | 0 |
| 748 | 0 | 0 | 0 | 0 | 0.5 |
| 749 | 0 | 0 | 0 | 0 | 0 |
| 750 | 0 | 0 | 0 | 0 | 0 |
| 751 | 0 | 0 | 0 | 0 | 0.5 |
| 752 | 0 | 0 | 0 | 0 | 0.75 |
| 753 | 0 | 0 | 0 | 0 | 0.5 |
| 754 | 0 | 0 | 0 | 0 | 0.75 |
| 755 | 0 | 0 | 0 | 0 | 0.5 |
| 756 | 0 | 0 | 0 | 0 | [illegible].0 |
| 757 | 0 | 0 | 0 | 0 | 1.0 |
| 758 | 0 | 0 | 0 | 0 | 0 |
| 759 | 0 | 0 | 0 | 0 | 0.5 |
| 760 | 0 | 0 | 0 | 0 | 1.25 |
| 761 | 0 | 0 | 0 | 0 | 1.5 |
| 762 | 0 | 0 | 0 | 0 | 0.75 |
| 763 | 0 | 0 | 0 | 0 | 0 |
| 764 | 0 | 0 | 0 | 0 | 1.5 |
| 765 | 0 | 0 | 0 | 0 | 0.75 |
| 766 | 0 | 0 | 0 | 0 | 0.5 |
| 767 | 0 | 0 | 0 | 0 | 0.75 |
| 768 | 0 | 0 | 0 | 0 | 0.25 |
| 769 | 0 | 0 | 0 | 0 | 1.5 |
| 770 | 0 | 0 | 0 | 0 | 1.0 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree x | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 2771 | 0 | 0 | 0 | 0 | 1.0 |
| 772 | 0 | 0 | 0 | 0 | 1.25 |
| 773 | 0 | 0 | 0 | 0 | 0.5 |
| 774 | 0 | 0 | 0 | 0 | 0 |
| 775 | 0 | 0 | 0 | 0 | 0 |
| 776 | 0 | 0 | 0 | 0 | 0 |
| 777 | 0 | 0 | 0 | 0 | 0 |
| 778 | 0 | 0 | 0 | 0 | 0 |
| 779 | 0 | 0 | 0 | 0 | 0 |
| 780 | 0 | 0 | 0 | 0 | 0 |
| 781 | 0 | 0 | 0 | 0 | 1.0 |
| 782 | 0 | 0 | 0 | 0 | 0 |
| 783 | 0 | 0 | 0 | 0 | 0 |
| 784 | 0 | 0 | 0 | 0 | 1.0 |
| 785 | 0 | 0 | 0 | 0 | 0 |
| 786 | 0 | 0 | 0 | 0 | 0 |
| 787 | 0 | 0 | 0 | 0 | 1.0 |
| 788 | 0 | 0 | 0 | 0 | 0.5 |
| 789 | 0 | 0 | 0 | 0 | 1.25 |
| 790 | 0 | 0 | 0 | 0 | 0.75 |
| 791 | 0 | 0 | 0 | 0 | 0 |
| 792 | 0 | 0 | 0 | 0 | 0 |
| 793 | 0 | 0 | 0 | 0 | 0 |
| 794 | 0 | 0 | 0 | 0 | 0.5 |
| 795 | 0 | 0 | 0 | 0 | 0.5 |
| 796 | 0 | 0 | 0 | 0 | 0 |
| 797 | 0 | 0 | 0 | 0 | 1.0 |
| 798 | 0 | 0 | 0 | 0 | 0.25 |
| 799 | 0 | 0 | 0 | 0 | 0.5 |
| 2800 | 0 | 0 | 0 | 0 | 1.25 |
| 801 | 0 | 0 | 0 | 0 | 0 |
| 802 | 0 | 0 | 0 | 0 | 1.5 |
| 803 | 0 | 0 | 0 | 0 | 1.0 |

| Grid No. | Height in meter | | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| | Maximum | Minimum | | | |
| 2804 | 10 | 10 | 0 | 0.4 | 1.0 |
| 805 | 0 | 0 | 0 | 0 | 2.0 |
| 806 | 0 | 0 | 0 | 0 | 1.0 |
| 807 | 0 | 0 | 0 | 0 | 0.5 |
| 808 | 0 | 0 | 0 | 0 | 0 |
| 809 | 0 | 0 | 0 | 0 | 0 |
| 810 | 0 | 0 | 0 | 0 | 0.75 |
| 811 | 0 | 0 | 0 | 0 | 0.5 |
| 812 | 0 | 0 | 0 | 0 | 0.5 |
| 813 | 0 | 0 | 0 | 0 | 0.5 |
| 814 | 0 | 0 | 0 | 0 | 1.0 |
| 815 | 0 | 0 | 0 | 0 | 1.5 |
| 816 | 0 | 0 | 0 | 0 | 0 |
| 817 | 0 | 0 | 0 | 0 | 0 |
| 818 | 0 | 0 | 0 | 0 | 0 |
| 819 | 0 | 0 | 0 | 0 | 0 |
| 820 | 0 | 0 | 0 | 0 | 0.75 |
| 821 | 0 | 0 | 0 | 0 | 0.75 |
| 822 | 0 | 0 | 0 | 0 | 1.5 |
| 823 | 0 | 0 | 0 | 0 | 0.75 |
| 824 | 0 | 0 | 0 | 0 | 0.5 |
| 825 | 0 | 0 | 0 | 0 | 0.75 |
| 826 | 0 | 0 | 0 | 0 | 0.25 |
| 827 | 0 | 0 | 0 | 0 | 1.5 |
| 828 | 0 | 0 | 0 | 0 | 0 |
| 829 | 0 | 0 | 0 | 0 | 0 |
| 830 | 0 | 0 | 0 | 0 | 1.75 |
| 831 | 0 | 0 | 0 | 0 | 1.5 |
| 832 | 0 | 0 | 0 | 0 | 1.0 |
| 833 | 0 | 0 | 0 | 0 | 1.0 |
| 834 | 0 | 0 | 0 | 0 | 0 |
| 835 | 0 | 0 | 0 | 0 | 0 |

| Grid No. | Height in meter | | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| | Maximum | Minimum | | | |
| 2836 | 0 | 0 | 0 | 0 | 1.0 |
| 837 | 0 | 0 | 0 | 0 | 0 |
| 838 | 0 | 0 | 0 | 0 | 0 |
| 839 | 0 | 0 | 0 | 0 | 1.0 |
| 840 | 0 | 0 | 0 | 0 | 1.0 |
| 841 | 0 | 0 | 0 | 0 | 1.25 |
| 842 | 0 | 0 | 0 | 0 | 0.5 |
| 843 | 0 | 0 | 0 | 0 | 1.0 |
| 844 | 0 | 0 | 0 | 0 | 0.25 |
| 845 | 0 | 0 | 0 | 0 | 1.0 |
| 846 | 0 | 0 | 0 | 0 | 0 |
| 847 | 0 | 0 | 0 | 0 | 1.25 |
| 848 | 0 | 0 | 0 | 0 | 0.25 |
| 849 | 0 | 0 | 0 | 0 | 0 |
| 850 | 0 | 0 | 0 | 0 | 0.5 |
| 851 | 0 | 0 | 0 | 0 | 0.5 |
| 852 | 0 | 0 | 0 | 0 | 0 |
| 853 | 0 | 0 | 0 | 0 | 0.5 |
| 854 | 0 | 0 | 0 | 0 | 2.0 |
| 855 | 0 | 0 | 0 | 0 | 2.5 |
| 856 | 0 | 0 | 0 | 0 | 0.5 |
| 857 | 0 | 0 | 0 | 0 | 2.0 |
| 858 | 0 | 0 | 0 | 0 | 1.25 |
| 859 | 0 | 0 | 0 | 0 | 1.5 |
| 860 | 0 | 0 | 0 | 0 | 2.0 |
| 861 | 0 | 0 | 0 | 0 | 1.5 |
| 862 | 0 | 0 | 0 | 0 | 1.25 |
| 863 | 0 | 0 | 0 | 0 | 2.0 |
| 864 | 0 | 0 | 0 | 0 | 1.5 |
| 865 | 0 | 0 | 0 | 0 | 1.5 |
| 866 | 0 | 0 | 0 | 0 | 0.5 |
| 867 | 0 | 0 | 0 | 0 | 0 |
| 868 | 0 | 0 | 0 | 0 | 0 |
| 869 | 0 | 0 | 0 | 0 | 0 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 2870 | 0 | 0 | 0 | 0 | 1.25 |
| 871 | 0 | 0 | 0 | 0 | 1.0 |
| 872 | 0 | 0 | 0 | 0 | 1.0 |
| 873 | 0 | 0 | 0 | 0 | 2.0 |
| 874 | 0 | 0 | 0 | 0 | 0 |
| 875 | 0 | 0 | 0 | 0 | 0 |
| 876 | 0 | 0 | 0 | 0 | 1.5 |
| 877 | 0 | 0 | 0 | 0 | 1.25 |
| 878 | 0 | 0 | 0 | 0 | 0.25 |
| 879 | 0 | 0 | 0 | 0 | 0 |
| 880 | 0 | 0 | 0 | 0 | 0 |
| 881 | 0 | 0 | 0 | 0 | 0 |
| 882 | 0 | 0 | 0 | 0 | 0.5 |
| 883 | 0 | 0 | 0 | 0 | 0.5 |
| 884 | 0 | 0 | 0 | 0 | 0 |
| 885 | 0 | 0 | 0 | 0 | 0 |
| 886 | 0 | 0 | 0 | 0 | 0 |
| 887 | 0 | 0 | 0 | 0 | 1.0 |
| 888 | 0 | 0 | 0 | 0 | 1.5 |
| 889 | 0 | 0 | 0 | 0 | 0.75 |
| 890 | 0 | 0 | 0 | 0 | 1.0 |
| 891 | 0 | 0 | 0 | 0 | 0 |
| 892 | 0 | 0 | 0 | 0 | 0 |
| 893 | 0 | 0 | 0 | 0 | 2.0 |
| 894 | 0 | 0 | 0 | 0 | 1.0 |
| 895 | 0 | 0 | 0 | 0 | 0 |
| 896 | 0 | 0 | 0 | 0 | 0.25 |
| 897 | 0 | 0 | 0 | 0 | 0.5 |
| 898 | 0 | 0 | 0 | 0 | 0.75 |
| 899 | 0 | 0 | 0 | 0 | 0 |
| 2900 | 0 | 0 | 0 | 0 | 0.25 |
| 901 | 0 | 0 | 0 | 0 | 1.0 |
| 902 | 0 | 0 | 0 | 0 | 0 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 2903 | 0 | 0 | 0 | 0 | 1.0 |
| 904 | 0 | 0 | 0 | 0 | 1.0 |
| 905 | 0 | 0 | 0 | 0 | 2.0 |
| 906 | 0 | 0 | 0 | 0 | 1.0 |
| 907 | 0 | 0 | 0 | 0 | 0.5 |
| 908 | 0 | 0 | 0 | 0 | 0 |
| 909 | 0 | 0 | 0 | 0 | 0 |
| 910 | 0 | 0 | 0 | 0 | 0 |
| 911 | 0 | 0 | 0 | 0 | 0 |
| 912 | 0 | 0 | 0 | 0 | 0 |
| 913 | 0 | 0 | 0 | 0 | 2.0 |
| 914 | 0 | 0 | 0 | 0 | 2.0 |
| 915 | 0 | 0 | 0 | 0 | 1.75 |
| 916 | 0 | 0 | 0 | 0 | 0.5 |
| 917 | 0 | 0 | 0 | 0 | 1.0 |
| 918 | 0 | 0 | 0 | 0 | 1.0 |
| 919 | 0 | 0 | 0 | 0 | 0.75 |
| 920 | 0 | 0 | 0 | 0 | 1.0 |
| 921 | 0 | 0 | 0 | 0 | 1.0 |
| 922 | 0 | 0 | 0 | 0 | 1.0 |
| 923 | 0 | 0 | 0 | 0 | 0 |
| 924 | 0 | 0 | 0 | 0 | 0.25 |
| 925 | 0 | 0 | 0 | 0 | 1.0 |
| 926 | 0 | 0 | 0 | 0 | 1.5 |
| 927 | 0 | 0 | 0 | 0 | 0 |
| 928 | 0 | 0 | 0 | 0 | 0 |
| 929 | 0 | 0 | 0 | 0 | 1.0 |
| 930 | 0 | 0 | 0 | 0 | 0 |
| 931 | 0 | 0 | 0 | 0 | 0 |
| 932 | 0 | 0 | 0 | 0 | 1.0 |
| 933 | 0 | 0 | 0 | 0 | 0 |
| 934 | 0 | 0 | 0 | 0 | 1.0 |
| 935 | 0 | 0 | 0 | 0 | 1.5 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 2936 | 0 | 0 | 0 | 0 | 1.0 |
| 937 | 0 | 0 | 0 | 0 | 0 |
| 938 | 0 | 0 | 0 | 0 | 0 |
| 939 | 0 | 0 | 0 | 0 | 0.5 |
| 940 | 0 | 0 | 0 | 0 | 1.0 |
| 941 | 0 | 0 | 0 | 0 | 1.0 |
| 942 | 0 | 0 | 0 | 0 | 0 |
| 943 | 0 | 0 | 0 | 0 | 0 |
| 944 | 0 | 0 | 0 | 0 | 0.5 |
| 945 | 0 | 0 | 0 | 0 | 1.0 |
| 946 | 0 | 0 | 0 | 0 | 1.0 |
| 947 | 0 | 0 | 0 | 0 | 0.75 |
| 948 | 0 | 0 | 0 | 0 | 1.0 |
| 949 | 0 | 0 | 0 | 0 | 1.0 |
| 950 | 0 | 0 | 0 | 0 | 0 |
| 951 | 0 | 0 | 0 | 0 | 0.5 |
| 952 | 0 | 0 | 0 | 0 | 1.0 |
| 953 | 0 | 0 | 0 | 0 | 0.5 |
| 954 | 0 | 0 | 0 | 0 | 0 |
| 955 | 0 | 0 | 0 | 0 | 0 |
| 956 | 0 | 0 | 0 | 0 | 0 |
| 957 | 0 | 0 | 0 | 0 | 0.5 |
| 958 | 0 | 0 | 0 | 0 | 1.5 |
| 959 | 0 | 0 | 0 | 0 | 1.0 |
| 960 | 0 | 0 | 0 | 0 | 1.5 |
| 961 | 0 | 0 | 0 | 0 | 0.5 |
| 962 | 0 | 0 | 0 | 0 | 1.0 |
| 963 | 0 | 0 | 0 | 0 | 1.0 |
| 964 | 0 | 0 | 0 | 0 | 1.0 |
| 965 | 0 | 0 | 0 | 0 | 1.0 |
| 966 | 0 | 0 | 0 | 0 | 1.0 |
| 967 | 0 | 0 | 0 | 0 | 1.0 |
| 968 | 0 | 0 | 0 | 0 | 0 |

| Grid No. | Height in meter | | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| | Maximum | Minimum | | | |
| 2969 | 0 | 0 | 0 | 0 | 0 |
| 970 | 0 | 0 | 0 | 0 | 1.0 |
| 971 | 0 | 0 | 0 | 0 | 1.5 |
| 972 | 0 | 0 | 0 | 0 | 0 |
| 973 | 0 | 0 | 0 | 0 | 0 |
| 974 | 0 | 0 | 0 | 0 | 0 |
| 975 | 0 | 0 | 0 | 0 | 0 |
| 976 | 0 | 0 | 0 | 0 | 0 |
| 977 | 0 | 0 | 0 | 0 | 1.0 |
| 978 | 0 | 0 | 0 | 0 | 1.0 |
| 979 | 0 | 0 | 0 | 0 | 0.75 |
| 980 | 0 | 0 | 0 | 0 | 1.0 |
| 981 | 0 | 0 | 0 | 0 | 0.75 |
| 982 | 0 | 0 | 0 | 0 | 0.5 |
| 983 | 0 | 0 | 0 | 0 | 0 |
| 984 | 0 | 0 | 0 | 0 | 0 |
| 985 | 0 | 0 | 0 | 0 | 0.75 |
| 986 | 0 | 0 | 0 | 0 | 2.0 |
| 987 | 0 | 0 | 0 | 0 | 1.5 |
| 988 | 0 | 0 | 0 | 0 | 1.0 |
| 989 | 0 | 0 | 0 | 0 | 0 |
| 990 | 0 | 0 | 0 | 0 | 1.0 |
| 991 | 0 | 0 | 0 | 0 | 0 |
| 992 | 0 | 0 | 0 | 0 | 0 |
| 993 | 0 | 0 | 0 | 0 | 0 |
| 994 | 0 | 0 | 0 | 0 | 0 |
| 995 | 0 | 0 | 0 | 0 | 1.0 |
| 996 | 0 | 0 | 0 | 0 | 1.0 |
| 997 | 0 | 0 | 0 | 0 | 0 |
| 998 | 0 | 0 | 0 | 0 | 0 |
| 999 | 0 | 0 | 0 | 0 | 1.0 |
| 3000 | 0 | 0 | 0 | 0 | 1.5 |

| Grid No. | Height in meter Maximum | Minimum | Relative relief | Slope in degree | Drainage density (per sq.mile) |
|---|---|---|---|---|---|
| 3001 | 0 | 0 | 0 | 0 | 1.0 |
| 2 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 0 |
| 4 | 0 | 0 | 0 | 0 | 0 |
| 5 | 0 | 0 | 0 | 0 | 0 |
| 6 | 0 | 0 | 0 | 0 | 1.0 |
| 7 | 0 | 0 | 0 | 0 | 0.5 |
| 8 | 0 | 0 | 0 | 0 | 0 |
| 9 | 0 | 0 | 0 | 0 | 1.0 |
| 10 | 0 | 0 | 0 | 0 | 0.5 |
| 11 | 0 | 0 | 0 | 0 | 0.5 |
| 12 | 0 | 0 | 0 | 0 | 1.5 |
| 13 | 0 | 0 | 0 | 0 | 1.25 |
| 14 | 0 | 0 | 0 | 0 | 0.5 |
| 15 | 0 | 0 | 0 | 0 | 0.75 |
| 16 | 0 | 0 | 0 | 0 | 0.25 |
| 17 | 0 | 0 | 0 | 0 | 1.0 |
| 18 | 0 | 0 | 0 | 0 | 1.25 |
| 19 | 0 | 0 | 0 | 0 | 1.0 |
| 20 | 0 | 0 | 0 | 0 | 0 |
| 21 | 0 | 0 | 0 | 0 | 1.25 |

TABLE 3.1

Total Annual Rainfall

| Year | Burdwan | Mongalkote | Monteswar | Shyamsundar (Raina PS) | Mankar (Galsi P.S.) | Asansol | Kalna | Katwa |
|---|---|---|---|---|---|---|---|---|
| 1901 | 481.1 | - | - | - | 568.6 | - | 515.6 | 584.2 |
| 1902 | 460.7 | - | - | - | 442.1 | - | 444.5 | 455.5 |
| 1903 | 575.6 | - | - | - | 471.0 | - | 602.3 | 437.2 |
| 1904 | 447.1 | - | - | - | 430.6 | - | 577.4 | 417.6 |
| 1905 | 575.6 | - | - | - | 542.5 | - | 572.6 | 725.0 |
| 1906 | 731.0 | - | - | - | 583.4 | - | 504.3 | 485.2 |
| 1907 | 442.3 | - | - | - | 386.5 | - | 527.4 | 274.0 |
| 1908 | 654.7 | - | - | - | 524.8 | - | 611.5 | 646.5 |
| 1909 | 736.5 | - | - | - | 744.5 | - | 775.5 | 773.2 |
| 1910 | 541.5 | - | - | - | 429.4 | - | 586.4 | 765.3 |
| 1911 | 470.4 | 564.2 | - | - | 444.1 | - | 525.9 | 567.7 |
| 1912 | 513.3 | 415.0 | - | - | 384.1 | - | 373.7 | 516.1 |
| 1913 | 749.9 | 666.5 | 622.8 | 525.2 | 671.1 | 800.8 | 710.9 | 603.1 |
| 1914 | 556.8 | 239.6 | 320.5 | 573.9 | 596.2 | 443.4 | 579.7 | 516.4 |
| 1915 | 548.9 | 560.5 | 625.4 | 445.8 | 454.9 | 309.5 | 558.3 | 493.7 |
| 1916 | 907.7 | 419.8 | 379.6 | 674.5 | 640.7 | 625.1 | 617.1 | 600.1 |
| 1917 | 636.6 | 758.4 | 883.2 | 654.7 | 558.7 | 804.0 | 649.3 | 650.7 |
| 1918 | 682.3 | 507.0 | - | 483.7 | 482.9 | 383.7 | 545.6 | 611.8 |
| 1919 | 565.3 | 315.4 | 617.3 | 434.0 | 339.3 | 583.1 | 520.1 | 477.6 |
| 1920 | 536.7 | 597.6 | 611.5 | 475.2 | 446.8 | 462.6 | 408.5 | 646.9 |
| 1921 | 517.8 | 706.7 | 624.4 | 474.7 | 382.2 | 472.5 | 447.6 | 484.1 |
| 1922 | 743.7 | 813.3 | - | 314.0 | 334.7 | 840.6 | 345.0 | 560.9 |

Table 3.1 (contd.)

| Year | Burdwan | Mongalkote | Monteswar | Shyamsundar (Raina P.S.) | Mankar (Galsi P.S.) | Asansol | Kalna | Katwa |
|---|---|---|---|---|---|---|---|---|
| 1923 | 687.2 | 270.3 | - | 341.5 | 311.4 | 560.4 | 499.2 | 421.5 |
| 1924 | 564.2 | - | - | 542.2 | 441.2 | 707.4 | 457.9 | 551.0 |
| 1925 | 455.4 | - | 327.9 | 684.6 | 241.5 | 504.8 | 395.0 | 563.7 |
| 1926 | 705.3 | - | 401.1 | 705.5 | 487.7 | 684.5 | 598.1 | 281.6 |
| 1927 | 515.8 | 152.5 | 249.6 | 413.6 | 355.5 | 615.0 | 353.8 | 365.6 |
| 1928 | 732.1 | 1059.4 | 1215.5 | 205.7 | 554.4 | 637.7 | 620.9 | 515.3 |
| 1929 | 691.1 | 391.9 | - | - | 483.3 | 633.9 | 509.4 | 631.4 |
| 1930 | 753.6 | 308.7 | - | - | 499.5 | 531.3 | 462.7 | - |
| 1931 | 619.7 | 644.9 | 470.1 | 484.9 | 622.3 | 471.8 | 495.0 | - |
| 1932 | 575.5 | 411.0 | 356.0 | - | 324.6 | 408.4 | 500.9 | 432.0 |
| 1933 | 718.7 | 916.3 | 766.6 | 594.6 | 618.0 | 541.1 | 614.6 | 634.4 |
| 1934 | 499.9 | 385.7 | 435.7 | 436.1 | 368.8 | 444.6 | 397.2 | 387.1 |
| 1935 | 367.9 | 304.4 | 158.3 | 408.1 | 416.4 | 479.0 | 396.3 | 336.4 |
| 1936 | 714.2 | 495.4 | 548.0 | 595.4 | 603.5 | 483.9 | 484.9 | 517.8 |
| 1937 | 588.1 | 361.1 | 499.3 | 655.9 | 557.9 | 414.1 | 546.9 | 540.8 |
| 1938 | 610.5 | 470.9 | 480.1 | 510.2 | 530.6 | 487.7 | 613.1 | 613.2 |
| 1939 | 585.1 | 427.1 | 618.2 | 646.6 | 576.9 | 568.6 | 496.2 | 715.0 |
| 1940 | 466.9 | 224.5 | 349.1 | 340.7 | 381.0 | 494.9 | 376.6 | 362.8 |
| 1941 | 720.4 | 529.7 | 462.1 | 565.7 | 601.6 | 631.9 | 664.5 | 618.2 |
| 1942 | 564.9 | 524.3 | 367.1 | 263.4 | 427.0 | 715.9 | 421.0 | 632.2 |
| 1943 | 655.9 | - | 346.0 | - | 647.2 | 633.4 | 581.0 | 476.4 |
| 1944 | 571.5 | - | 260.2 | - | 319.2 | 523.6 | 683.0 | 494.5 |
| 1945 | 416.8 | - | 427.4 | - | 292.6 | 620.3 | 532.7 | 488.4 |
| 1946 | 593.6 | - | - | 261.0 | 633.2 | 747.9 | 312.9 | 573.2 |
| 1947 | 567.6 | - | - | - | - | 616.4 | 266.3 | 574.0 |
| 1948 | 484.9 | - | - | - | 346.1 | 504.1 | 492.8 | 505.9 |
| 1949 | 623.2 | - | 437.5 | - | 473.2 | 533.1 | 615.1 | - |
| 1950 | 596.7 | - | 444.7 | - | 407.0 | 561.4 | 398.8 | 594.0 |

Co-efficient of variability of Rainfall (during 1901-1950)

Burdwan - 17.56, Mangalkote - 48.36, Monteswar - 39.61, Shyamsundar - 28.27, Mankar - 23.27, Asansol - 32.61
Kalna - 20.67, Katwa - 21.30

## Table 3.2

**Total annual rainfall (in centimeter) and No. of rainy days**

| | Hirapur | Asansol | Burdwan | Hirapur | Asansol | Burdwan |
|---|---|---|---|---|---|---|
| 1946 | 159.60 | 109.42 | 154.86 | 112 | 95 | 110 |
| 1947 | 136.88 | 152.56 | 129.50 | 89 | 108 | 93 |
| 1948 | 136.41 | 153.46 | 121.41 | 95 | 132 | 104 |
| 1949 | 117.24 | 136.63 | 137.52 | 103 | 107 | 118 |
| 1950 | 144.17 | 142.59 | 130.85 | 95 | 103 | 107 |
| 1951 | 104.90 | 120.03 | 107.50 | 89 | 95 | 81 |
| 1952 | 131.85 | 132.50 | 114.94 | 95 | 108 | 93 |
| 1953 | 129.74 | 131.18 | 135.27 | 83 | 110 | 90 |
| 1954 | 111.33 | 115.05 | 110.43 | 65 | 62 | 72 |
| 1955 | 89.76 | 96.31 | 99.30 | 62 | 64 | 70 |
| 1956 | 172.08 | 187.66 | 159.70 | 87 | 90 | 81 |
| 1957 | 110.24 | 121.41 | 99.70 | 60 | 61 | 56 |
| 1958 | 85.88 | 97.63 | n85.90 | 57 | 60 | 55 |
| 1959 | 177.50 | 187.60 | 172.20 | 96 | 91 | 94 |
| 1960 | 87.06 | 96.69 | 100.70 | 58 | 69 | 64 |
| 1961 | 106.30 | 132.10 | 112.30 | 69 | 76 | 75 |
| 1962 | 92.78 | 119.83 | 89.93 | 62 | 67 | 66 |
| 1963 | 95.57 | 126.29 | 116.76 | 59 | 63 | 65 |
| 1964 | 108.87 | 120.35 | 140.88 | 88 | 74 | 78 |
| 1965 | 83.70 | 107.88 | 129.80 | 75 | 62 | 59 |
| 1966 | 69.22 | 93.96 | 109.55 | 72 | 66 | 69 |
| 1967 | 117.90 | 135.31 | 121.68 | 85 | 72 | 71 |
| 1968 | 111.20 | 153.43 | 136.61 | 81 | 76 | 66 |
| 1969 | 92.04 | 118.56 | 128.90 | 84 | 92 | 88 |
| 1970 | 147.84 | 127.44 | 155.40 | 83 | 101 | 94 |
| 1971 | 175.49 | 185.32 | 190.5 | 90 | 111 | 108 |
| 1972 | 158.17 | 102.07 | 131.20 | 82 | m79 | 73 |
| 1973 | 137.88 | 138.45 | 138.42 | 97 | 118 | 106 |
| 1974 | 119.91 | 138.06 | 138.07 | 75 | 94 | 88 |
| 1975 | 119.22 | 124.04 | 103.16 | 75 | 97 | 90 |

**TABLE 3.3**

**Mean Annual Temperature (in°C)**

| | Hirapur | Asansol | Burdwan |
|---|---|---|---|
| 1946 | 27.16 | 25.94 | 26.33 |
| 1947 | 28.56 | 26.17 | 27.02 |
| 1948 | 28.84 | 26.59 | 26.90 |
| 1949 | 26.32 | 25.97 | 26.28 |
| 1950 | 25.76 | 26.32 | 26.71 |
| 1951 | 28.94 | 26.90 | 27.26 |
| 1952 | 28.28 | 26.84 | 27.04 |
| 1953 | 29.40 | 27.30 | 26.73 |
| 1954 | 27.30 | 26.79 | 26.60 |
| 1955 | 28.0 | 26.63 | 27.22 |
| 1956 | 28.42 | 26.03 | 26.22 |
| 1957 | 29.26 | 26.83 | 26.43 |
| 1958 | 29.40 | 27.57 | 26.93 |
| 1959 | 28.42 | 26.48 | 25.14 |
| 1960 | 29.04 | 26.7 | 25.61 |
| 1961 | 25.42 | 26.11 | 25.07 |
| 1962 | 27.16 | 26.04 | 26.65 |
| 1963 | 27.10 | 27.16 | 26.27 |
| 1964 | 27.35 | 26.62 | 28.29 |
| 1965 | 26.71 | 26.34 | 27.07 |
| 1966 | 28.08 | 27.19 | 27.92 |
| 1967 | 28.02 | 26.36 | 26.53 |
| 1968 | 27.60 | 26.32 | 27.21 |
| 1969 | 27.52 | 26.33 | 26.96 |
| 1970 | 26.68 | 26.54 | 27.12 |
| 1971 | 25.73 | 25.68 | 25.25 |
| 1972 | 26.70 | 27.02 | 27.62 |
| 1973 | 26.20 | 26.52 | 26.94 |
| 1974 | 26.96 | 26.04 | 26.95 |
| 1975 | 26.22 | 26.02 | 26.62 |

**TABLE 3.4**

**Monthly variation of rainfall and temperature in Hirapur, Asansol and Burdwan**

| Year | Hirapur(1970) Rainfall (cm) | Hirapur(1970) Temp (°C) | Asansol (1970) Rainfall (cm) | Asansol (1970) Temp (°C) | Burdwan (1970) Rainfall (cm) | Burdwan (1970) Temp. (°C) |
|---|---|---|---|---|---|---|
| January | 0.78 | 17.74 | 0.97 | 18.4 | 1.5 | 20.0 |
| February | 0.2 | 21.95 | 0.2 | 21.6 | 0 | 23.0 |
| March | 0.8 | 29.16 | 1.67 | 26.4 | 2.0 | 28.0 |
| April | 0.55 | 33.3 | 0.74 | 32.3 | 0.4 | 32.0 |
| May | 0.52 | 33.6 | 1.9 | 33.7 | 3.7 | 33.5 |
| June | 21.10 | 30.82 | 23.05 | 30.5 | 20.8 | 30.0 |
| July | 37.90 | 30.8 | 29.42 | 29.7 | 26.5 | 29.5 |
| August | 26.96 | 29.4 | 23.64 | 29.3 | 27.9 | 29.5 |
| September | 45.44 | 27.75 | 32.63 | 28.2 | 51.9 | 29.0 |
| October | 13.08 | 26.05 | 13.22 | 27.5 | 20.2 | 28.0 |
| November | 0.51 | 21.9 | 0 | 22.25 | 0.5 | 23.5 |
| December | 0 | 17.75 | 0 | 18.65 | 0 | 19.5 |

TABLE 3.5

Temporal variation of average annual rainfall and yield of crops

| Year | Average annual rainfall (cm) | Yield Rate (Qtl/Hect) Aman | Aus |
|---|---|---|---|
| 1947-48 | 137.09 | 9.80 | 4.74 |
| 1948-49 | 130.46 | 9.33 | 8.56 |
| 1949-50 | 139.20 | 9.67 | 9.35 |
| 1950-51 | 110.81 | 12.09 | 11.53 |
| 1950-52 | 126.43 | 10.71 | 7.48 |
| 1952-53 | 132.06 | 10.81 | 10.64 |
| 1953-54 | 112.27 | 15.85 | 10.24 |
| 1954-55 | 95.12 | 12.98 | 12.76 |
| 1955-56 | 173.15 | 11.55 | 9.55 |
| 1956-57 | 110.45 | 11.70 | 10.71 |
| 1957-58 | 89.80 | 13.11 | 8.22 |
| 1958-59 | 179.10 | 11.80 | 10.86 |
| 1959-60 | 94.82 | 15.33 | 11.75 |
| 1960-61 | 116.90 | 13.97 | 6.17 |
| 1961-62 | 100.85 | 13.35 | 9.40 |
| 1962-63 | 112.87 | 15.97 | 10.19 |
| 1963-64 | 123.37 | 15.18 | 12.09 |
| 1964-65 | 107.13 | 14.81 | 11.82 |
| 1965-66 | 90.91 | 13.82 | 10.59 |
| 1966-67 | 124.93 | 13.85 | 10.81 |
| 1967-68 | 133.75 | 15.40 | 10.86 |
| 1968-69 | 113.17 | 23.18 | 20.27 |
| 1969-70 | 143.56 | 21.65 | 27.85 |
| 1970-71 | 183.77 | 19.01 | 30.27 |
| 1971-72 | 130.48 | 21.20 | 27.13 |
| 1972-73 | 138.25 | 19.85 | 23.45 |
| 1973-74 | 132.01 | 23.06 | 26.91 |
| 1974-75 | 115.47 | 26.91 | 26.80 |
| 1975-76 | 110.73 | 22.98 | 25.62 |
| 1976-77 | 162.37 | 22.90 | 25.62 |
| 1977-78 | 262.60 | 30.86 | 31.35 |

## TABLE 3.6

### Relative Humidity and Temperature of the District of Burdwan

| | Relative Humidity (RH) in percentages<br>Temperature (Temp) in degree centigrades | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1969 | | 1970 | | 1971 | | 1972 | | 1973 | | 1974 | | 1975 | |
| | RH | Temp | RH | Temp | RH | Temp | RH | Temp | RH | Temp | RH | Temp | RH | Temp |
| January | 54 | 19.5 | 65 | 20.0 | 64 | 19.5 | 57 | 19.5 | 56 | 20.7 | 63 | 19.0 | 59 | 18.5 |
| February | 54 | 23.0 | 58 | 23.0 | 55 | 21.5 | 58 | 21.0 | 58 | 24.4 | 62 | 23.7 | 61 | 21.65 |
| March | 67 | 29.0 | 63 | 28.0 | 58 | 24.0 | 60 | 28.0 | 61 | 28.3 | 53 | 27.7 | 65 | 27.0 |
| April | 65 | 29.0 | 68 | 32.0 | 79 | 22.0 | 66 | 31.5 | 62 | 33.4 | 72 | 30.9 | 70 | 29.0 |
| May | 66 | 31.0 | 67 | 33.5 | 74 | 29.0 | 63 | 34.0 | 74 | 29.8 | 72 | 34.0 | 68. | 35.15 |
| June | 73 | 32.0 | 79 | 30.0 | 79 | 30.0 | 73 | 32.5 | 80 | 30.1 | 70 | 32.9 | 74 | 30.1 |
| July | 81 | 30.0 | 81 | 29.5 | 88 | 28.0 | 80 | 30.0 | 81 | 29.0 | 88 | 29.2 | 85 | 29.8 |
| August | 83 | 29.0 | 81 | 29.5 | 61 | 28.0 | 84 | 29.0 | 85 | 28,7 | 84 | 30.2 | 82 | 28,3 |
| September | 80 | 29.0 | 84 | 29.0 | 78 | 29.5 | 81 | 29.5 | 85 | 28.9 | 79 | 29,1 | 76 | 29.9 |
| October | 71 | 28.0 | 79 | 28.0 | 75 | 28.0 | 70 | 29.0 | 85 | 26.8 | 79 | 22.7 | 69 | 27.9 |
| November | 68 | 24.5 | 65 | 23.5 | 70 | 25.0 | 67 | 25.0 | 78 | 23.7 | 64 | 24.3 | 62 | 23.6 |
| December | 65 | 19.5 | 59 | 19.5 | 62 | 22.5 | 66 | 22.5 | 65 | 19.5 | 62 | 19.7 | 60 | 20.5 |

**TABLE 3.7**

Different types of climatic data of Asansol and B u r d w a n.

Height above mean sea level - 126 metres.

| | Station level pressure (mb) | Mean temperature (°C) | Relative humidity (%) | Vapour pressure (mb) | Cloud amount: All cloud (Oktas) | Cloud amount: Cloud cover | Cloud amount: Low cound of sky | Monthly Total rainfall (cm) | Mean Wind Speed (Km.ph.) | Percentage number of days of wind from: N | NE | E | SE | S | SW | W | NW | Calm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A S A N S O L** | | | | | | | | | | | | | | | | | | |
| Jan | 1000.9 | 19.0 | 56.0 | 12.25 | 1.8 | 1/6 | 0.55 | 1-66 | 5.3 | 11 | 3 | 3 | 0 | 0 | 1 | 17 | 35 | 27 |
| Feb | 998.25 | 21.7 | 50.5 | 13.05 | 1.85 | 1/6 | 0.5 | 2.43 | 6.2 | 10 | 3 | 3 | 3 | 1 | 2 | 25 | 32 | 21 |
| Mar. | 995.1 | 27.0 | 37.0 | 13.55 | 2.0 | 1/4 | 0.75 | 1.73 | 7.2 | 6 | 2 | 5 | 4 | 3 | 6 | 29 | 29 | 15 |
| Apr. | 991.4 | 30.85 | 38.0 | 17.15 | 2.45 | 1/4 | 1.15 | 2.39 | 8.2 | 4 | 4 | 11 | 10 | 7 | 8 | 24 | 20 | 11 |
| May | 987.6 | 33.1 | 52.0 | 24.8 | 3.4 | 1/3 | 1.7 | 7.3 | 8.9 | 3 | 7 | 21 | 23 | 12 | 7 | 9 | 10 | 7 |
| Jun | 984.15 | 32.75 | 69.5 | 30.5 | 5.9 | 2/3 | 2.95 | 19.24 | 8.6 | 3 | 9 | 25 | 23 | 11 | 8 | 7 | 6 | 8 |
| Jul | 984.1 | 29.45 | 82.0 | 32.5 | 6.95 | 3/4 | 4.05 | 34.44 | 8.1 | 3 | 8 | 25 | 22 | 10 | 8 | 9 | 4 | 11 |
| Aug. | 985.75 | 29.05 | 84.5 | 31.75 | 7.0 | 1 | 4.05 | 33.53 | 7.3 | 4 | 8 | 26 | 21 | 8 | 8 | 8 | 5 | 11 |
| Sept | 989.35 | 28.9 | 81.5 | 25.9 | 6.0 | 3/4 | 3.05 | 23.48 | 6.2 | 4 | 9 | 22 | 21 | 7 | 4 | 8 | 7 | 19 |
| Oct. | 995.05 | 25.85 | 73.0 | 16.85 | 3.6 | 1/3 | 1.8 | 11.29 | 4.8 | 10 | 8 | 10 | 9 | 2 | 1 | 11 | 17 | 31 |
| Nov. | 998.9 | 21.9 | 61.0 | 13.1 | 1.85 | 1/6 | 0.55 | 1.48 | 4.8 | 12 | 3 | 2 | 1 | 0 | 0 | 19 | 31 | 33 |
| Dec. | 1008.8 | 19.15 | 57.5 | 21.95 | 2.25 | 1/4 | 0.25 | 0.25 | 5.3 | 12 | 1 | 2 | 1 | 0 | 1 | 18 | 37 | 28 |
| Annual Mean | 992.65 | 26.55 | 62.0 | | 3.75 | | 1.8 | 139.22 | 6.7 | 7 | 5 | 13 | 12 | 5 | 4 | 15 | 20 | 19 |
| **B U R D W A N** | | | Height above mean sea level - 32 metres. | | | | | | | | | | | | | | | |
| Jan | 1011.85 | 19.7 | 59.5 | 14.05 | 1.35 | 1/6 | 0.5 | 1. 12 | 2.8 | 16 | 6 | 2 | 1 | 1 | 3 | 15 | 21 | 44 |
| Feb | 1009.35 | 22.05 | 54.5 | 15.1 | 1.8 | 1/4 | 0.5 | 2.46 | 3.3 | 13 | 5 | 3 | 3 | 3 | 7 | 8 | 19 | 41 |
| Mar. | 1006.15 | 26.8 | 49.5 | 17.9 | 1.8 | 1/4 | 0.9 | 2.5 | 5.2 | 7 | 3 | 2 | 3 | 9 | 15 | 12 | 14 | 35 |
| Apr. | 1002.3 | 30.75 | 53.5 | 23.4 | 2.0 | 1/3 | 1.3 | 4.61 | 6.7 | 3 | 3 | 5 | 11 | 17 | 24 | 7 | 6 | 25 |
| May | 998.35 | 31.8 | 64.5 | 29.7 | 3.15 | 2/3 | 1.95 | 11.48 | 9.3 | 1 | 3 | 10 | 23 | 25 | 22 | 2 | 2 | 10 |
| Jun | 995.0 | 31.35 | 76.0 | 32.45 | 5.1 | 3/4 | 3.05 | 19.60 | 8.1 | 2 | 4 | 12 | 23 | 20 | 18 | 2 | 3 | 15 |
| Jul | 994.95 | 29.2 | 83.5 | 33.3 | 5.5 | 1 | 3.9 | 31.44 | 7.1 | 2 | 3 | 14 | 21 | 15 | 20 | 3 | 2 | 18 |
| Aug | 996.45 | 29.2 | 86.0 | 32.9 | 5.45 | 1 | 3.9 | 30.12 | 6.3 | 2 | 4 | 17 | 21 | 15 | 16 | 3 | 2 | 19 |
| S pt. | 1000.1 | 95 | 1.5 | | 5.1 | 3/4 | 3.4 | 23.65 | 5. | 3 | 4 | 15 | 16 | 12 | 14 | 4 | 3 | |
| Oct. | 1005. | 26. | 75.5 | 28.2 | 3.05 | 2/3 | 1. | 10.68 | 4.0 | 13 | 9 | 7 | 6 | 4 | 7 | 4 | | 43 |

**TABLE 3.7 (contd.)**

| | Station level pressure (mb) | Mean temperature (°C) | Relative humidity (%) | Vapour pressure (mb) | Cloud amount All cloud (Oktas) | Cloud cover | Low cloud of sky | Monthly Total rainfall (cm) | Mean Wind Speed (Km.ph.) | Percentage number of days of wind from N | NE | E | SE | S | SW | W | NW | Calm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **B U R D W A N** | Height above mean sea level - 32. metres. | | | | | | | | | | | | | | | | | |
| Nov. | 1009.6 | 22.95 | 69.0 | 19.75 | 1.6 | 1/4 | 0.5 | 2.3 | 3.1 | 16 | 5 | 2 | 1 | 1 | 2 | 3 | 17 | 54 |
| Dec. | 1001.8 | 19.85 | 64.0 | 15.2 | 1.1 | 1/6 | 0.25 | 0.43 | 2.5 | 20 | 4 | 1 | 1 | 0 | 2 | 3 | 20 | 48 |
| Annual Mean | 1003.5 | 25.75 | 67.5 | 24.5 | 3.15 | | 1.9 | 140.39 | 5.3 | 8 | 4 | 8 | 11 | 10 | 12 | 5 | 10 | 32 |

Source : 1. Regional Meteorological Office, Calcutta.

2. River Research Institute, Galsi.

3. Town Engineering Department, Burnpur.

TABLE 4.1

Soil textural classification of Burdwan

| Name of the P.S. | Percentage of Sand | | % of Silt | % of Clay |
|---|---|---|---|---|
| | Coarse Sand | Fine Sand | | |
| Salanpur | 72.1 | | 8.8 | 19.1 |
| Kulti | 41.1 | | 22.8 | 36.1 |
| Hirapur | 27.15 | 33.50 | 10.7 | 28.65 |
| Barabani | 68.1 | | 8.8 | 23.1 |
| Jamuria | 23.0 | 38.7 | 14.9 | 23.22 |
| Raniganj | 10.6 | 26.6 | 22.2 | 40.33 |
| Andal | 67.1 | | 8.8 | 24.1 |
| Faridpur | 75.5 | | 8.4 | 16.10 |
| Kanksa | 22.63 | 56.37 | 10.0 | 11.0 |
| Ausgram | 34.5 | | 30.0 | 35.5 |
| Galsi | 43.3 | | 35.9 | 20.8 |
| Khandaghosh | 48.39 | | 26.43 | 25.18 |
| Raina | 16.3 | 25.3 | 17.3 | 41.1 |
| Jamalpur | 4.7 | 78.8 | 10.4 | 6.1 |
| Memari | 71.3 | | 10.0 | 18.7 |
| Burdwan | 15.65 | 36.30 | 28.43 | 19.62 |
| Bhatar | 12.57 | 33.08 | 20.5 | 33.85 |
| Mongalkote | 10.88 | 40.26 | 22.78 | 26.08 |
| Ketugram | 9.56 | 37.44 | 25.5 | 27.5 |
| Katwa | 50.3 | | 19.7 | 30.0 |
| Monteswar | 36.1 | 26.0 | 37.9 | 1.63 |
| Purbasthali | 50.3 | | 21.7 | 28.0 |
| Kalna | 28.7 | | 42.0 | 29.3 |

**TABLE 4.2**

Surface content of Airdry moisture and Clay

| Name of the P.S. | Percentage of air-dry moisture | Percentage of clay |
|---|---|---|
| Salanpur | 3.63 | 19.1 |
| Kulti | 1.58 | 36.1 |
| Hirapur | 1.16 | 28.65 |
| Barabani | 5.12 | 23.1 |
| Jamuria | 2.64 | 23.22 |
| Raniganj | 5.48 | 40.33 |
| Andal | 1.54 | 24.1 |
| Faridpur | 1.9 | 16.10 |
| Kanksa | 1.98 | 11.0 |
| Ausgram | 4.9 | 35.5 |
| Galsi | 3.1 | 20.8 |
| Khandaghosh | 4.2 | 25.15 |
| Raina | 1.3 | 41.1 |
| Jamalpur | 2.1 | 3.8 |
| Memari | 1.80 | 18.7 |
| Burdwan | 3.59 | 19.62 |
| Bhatar | 2.05 | 33.85 |
| Mongalkote | 5.8 | 26.08 |
| Ketugram | 2.5 | 27.5 |
| Katwa | 1.8 | 30.0 |
| Monteswar | 2.6 | 37.9 |
| Purbasthali | 6.5 | 28.0 |
| Kalna | 3.1 | 29.3 |

TABLE 4.3

Organic matter and pH content in the surface of soil

| Name of the P.S. | Percentage of organic matter | pH value |
|---|---|---|
| Salanpur | 2.07 | 5.8 |
| Kulti | 1.34 | 6.0 |
| Hirapur | 0.62 | 7.4 |
| Barabani | 0.67 | 5.9 |
| Jamuria | 1.67 | 6.8 |
| Raniganj | 0.45 | 6.9 |
| Andal | 0.53 | 5.8 |
| Faridpur | 0.60 | 5.6 |
| Kanksa | 0.90 | 5.2 |
| Ausgram | 1.03 | 6.9 |
| Galsi | 0.65 | 6.0 |
| Khandaghosh | 1.02 | 6.4 |
| Raina | 0.84 | 5.3 |
| Jamalpur | 0.41 | 6.5 |
| Memari | 0.78 | 4.7 |
| Burdwan | 0.81 | 4.9 |
| Bhatar | 1.22 | 4.5 |
| Mongalkote | 0.95 | 5.2 |
| Ketugram | 0.84 | 5.1 |
| Katwa | 0.53 | 6.8 |
| Monteswar | 0.76 | 5.6 |
| Purbasthali | 0.53 | 6.0 |
| Kalna | 0.84 | 7.7 |

TABLE 4.4

N.P.K. content in soil surface

| Name of the P.S. | Nitrogen | Phosphorus | Potassium | Total N.P.K. |
|---|---|---|---|---|
| | (In percentages) | | | |
| Salanpur | 0.081 | 0.075 | 0.62 | 0.776 |
| Kulti | 0.079 | 0.144 | 0.41 | 0.633 |
| Hirapur | 0.057 | 0.071 | 0.30 | 0.428 |
| Barabani | 0.037 | 0.155 | 0.52 | 0.712 |
| Jamuria | 0.109 | 0.092 | 0.26 | 0.461 |
| Raniganj | 0.03 | 0.084 | 0.47 | 0.584 |
| Andal | 0.030 | 0.052 | 0.12 | 0.202 |
| Faridpur | 0.028 | 0.023 | 0.21 | 0.261 |
| Kanksa | 0.051 | 0.014 | 0.11 | 0.175 |
| Ausgram | 0.071 | 0.02 | 0.49 | 0.581 |
| Galsi | 0.058 | 0.038 | 0.41 | 0.106 |
| Khandaghosh | 0.065 | 0.05 | 0.60 | 0.715 |
| Raina | 0.09 | 0.05 | 0.15 | 0.29 |
| Jamalpur | 0.02 | 0.03 | 0.06 | 0.11 |
| Memari | 0.044 | 0.059 | 0.08 | 0.183 |
| Burdwan | 0.052 | 0.06 | 0.275 | 0.387 |
| Bhatar | 0.056 | 0.024 | 0.43 | 0.510 |
| Mongalkote | 0.055 | 0.065 | 0.58 | 0.70 |
| Ketugram | 0.048 | 0.083 | 0.39 | 0.521 |
| Katwa | 0.032 | 0.033 | 0.17 | 0.235 |
| Monteswar | 0.064 | 0.044 | 0.28 | 0.388 |
| Purbasthali | 0.050 | 0.074 | 0.95 | 1.074 |
| Kalna | 0.054 | 0.06 | 0.4 | 0.514 |

TABLE 4.5

Calcium and Sesqui-oxide content in soil surface

| Name of the P.S. | Percentages of calcium | Percentages of Sesqui-oxide. |
|---|---|---|
| Salanpur | 0.36 | 16.94 |
| Kulti | 0.52 | 13.47 |
| Hirapur | 1.78 | 12.9 |
| Barabani | 0.44 | 17.50 |
| Jamuria | 0.38 | 10.30 |
| Raniganj | 0.81 | 14.60 |
| Andal | 0.42 | 7.16 |
| Faridpur | 0.39 | 6.0 |
| Kanksa | 0.43 | 6.35 |
| Ausgram | 2.39 | 16.0 |
| Galsi | 0.4 | 13.48 |
| Khandaghosh | 0.93 | 6.4 |
| Raina | 0.9 | 14.5 |
| Jamalpur | 0.7 | 5.8 |
| Memari | 0.69 | 6.03 |
| Burdwan | 0.43 | 9.02 |
| Bhatar | 0.39 | 11.6 |
| Mongalkote | 1.39 | 15.8 |
| Ketugram | 0.46 | 9.14 |
| Katwa | 2.05 | 5.3 |
| Monteswar | 0.48 | 11.4 |
| Purbasthali | 1.39 | 23.74 |
| Kalna | 2.33 | 11.71 |

TABLE 4.6

Silica and allumina content in soil surface

| Name of the P.S. | Percentages of Silica ($SiO_2$) | Percentages of Allumina ($Al_2O_3$) |
|---|---|---|
| Salanpur | 36.05 | 11.02 |
| Kulti | 20.55 | 7.41 |
| Hirapur | 30.32 | 8.5 |
| Barabani | 34.05 | 9.11 |
| Jamuria | 30.85 | 5.63 |
| Raniganj | 18.6 | 9.6 |
| Andal | 33.55 | 1.54 |
| Faridpur | 37.75 | 3.82 |
| Kanksa | 39.5 | 2.38 |
| Ausgram | 17.25 | - |
| Galsi | 21.65 | - |
| Kandhaghosh | 24.19 | 2.2 |
| Raina | 20.8 | 9.95 |
| Jamàlpur | 41.75 | 2.7 |
| Memari | 35.65 | 2.39 |
| Burdwan | 25.97 | 5.82 |
| Bhatar | 22.82 | 7.2 |
| Mongalkote | 25.57 | 10.84 |
| Ketugram | 23.5 | 5.75 |
| Katwa | 25.15 | 2.36 |
| Monteswar | 18.05 | - |
| Purbasthali | 25.15 | - |
| Kalna | 14.35 | 7.77 |

## TABEE 4.7

Genetic Study of Soil Pro files (Percentage constituents of Soils)

| Name of the P.S. | Dept in Cm. | Sand Coarse | Sand Fine | Silt | Clay | pH | Organic carbon | Airdry moisture | Calcium carbonate | Nitrogen | Phosphorus | Potassium | Ferrous oxide | Allumina | Sesqui oxide |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Salanpur | 0-15 | | 72.1 | 8.8 | 19.1 | 5.8 | 1.20 | 3.63 | 0.36 | 0.081 | 0.075 | 0.62 | 5.84 | 11.02 | 16.94 |
| | 15-30 | | 65.1 | 6.8 | 28.1 | 6.0 | 0.91 | 2.09 | 0.44 | 0.059 | 0.09 | 0.37 | 4.0 | 5.86 | 9.95 |
| Kulti | 0-17 | | 41.1 | 22.8 | 36.1 | 6.0 | 0.78 | 1.58 | 0.52 | 0.079 | 0.144 | 0.41 | 5.92 | 7.41 | 13.47 |
| | 17-65 | | 36.1 | 23.8 | 40.1 | 6.4 | 0.49 | 5.5 | 0.94 | 0.068 | 0.081 | 0.35 | 5.92 | 6. 04 | 12.04 |
| | 65-85 | | 31.1 | 20.8 | 48.1 | 6.6 | 0.24 | 3.77 | 0.94 | 0.031 | 0.066 | 0.26 | 5.84 | 5.38 | 11.29 |
| | 85-150 | | 24.1 | 16.8 | 57.1 | 6.6 | 0.14 | | 1.24 | 0.020 | | | | | |
| Hirapur | 0-8 | 27.15 | 33.50 | 10.70 | 28.65 | 7.4 | 0.36 | 1.16 | 1.78 | 0.057 | 0.071 | 0.30 | 4.4 | 8.5 | 12.9 |
| | 8-25 | 47.81 | 42.44 | 1.48 | 7.27 | 7.0 | 0.06 | 6.46 | 0.86 | 0.011 | 0.065 | 0.119 | 1.7 | 2.3 | 10.0 |
| | 25-48 | 4.42 | 53.3 | 18.8 | 23.48 | 7.2 | 0.07 | 2.81 | 1.89 | 0.007 | 0.085 | 0.54 | 6.7 | 11.6 | 18.4 |
| Barabani | 0-18 | | 68.1 | 8.8 | 23.1 | 5.9 | 0.39 | 5.12 | 0.44 | 0.037 | 0.155 | 0.52 | 8.24 | 9.11 | 17.50 |
| | 18-38 | | 45.1 | 18.8 | 36.1 | 6.6 | 0.18 | 5.14 | 0.98 | 0.015 | 0.181 | 0.61 | 7.92 | 9.57 | 17.68 |
| | 38-90 | | 37.1 | 23.8 | 39.1 | 6.8 | 0.16 | 5.08 | 1.44 | 0.015 | 0.179 | 0.60 | 15.92 | 9.53 | 25.63 |
| | 90-150 | | 36.1 | 19.8 | 44.1 | 7.0 | 0.09 | - | 3.02 | 0.008 | | | | | |
| Jamuria | 0-10 | 23.0 | 38.7 | 14.9 | 23.22 | 6.8 | 0.97 | 2.64 | 0.38 | 0.109 | 0.092 | 0.26 | 4.56 | 5.63 | 10.30 |
| | 10-32 | 24.0 | 30.6 | 13.5 | 31.9 | 6.6 | 0.14 | 3.32 | 0.29 | 0.028 | 0.051 | 0.37 | 8.32 | 8.25 | 16.63 |
| | 32-48 | 8.9 | 45.6 | 19.8 | 25.75 | 7.0 | 0.08 | 2.96 | 0.33 | 0.02 | 0.059 | 0.36 | 7.20 | 6.47 | 13.73 |
| Raniganj | 0-15 | 23.0 | 38.7 | 14.9 | 23.22 | 6.8 | 0.97 | 2.64 | 0.38 | 0.199 | 0.092 | 0.26 | 4.56 | 5.63 | 10.30 |
| | 15-32 | 24.0 | 30.6 | 13.5 | 31.9 | 6.6 | 0.14 | 3.32 | 0.29 | 0.028 | 0.051 | 0.37 | 8.32 | 8.25 | 16.63 |
| | 32-48 | 8.9 | 45.6 | 19.8 | 25.75 | 7.0 | 0.08 | 2.96 | 0.33 | 0.20 | 0.059 | 0.36 | 7.20 | 6.47 | 13.73 |
| Andal | 0-17 | | 67.1 | 8.8 | 24.1 | 5.8 | 0.31 | 1.54 | 0.42 | 0.030 | 0.052 | 0.12 | 1.76 | 1.54 | 7.16 |
| | 17-45 | | 60.1 | 9.8 | 30.1 | 6.2 | 0.19 | 1.67 | 0.68 | 0.017 | 0.056 | 0.19 | 3.68 | 3.50 | 9.13 |
| | 45-95 | | 46.1 | 13.8 | 36.1 | 6.6 | 0.12 | 2.30 | 1.62 | 0.011 | 0.046 | 0.21 | 4.0 | 4.68 | 5.76 |
| Faridpur | 0-27 | | 75.50 | 8.40 | 16.10 | 5.6 | 0.35 | 1.9 | 0.39 | 0.028 | 0.023 | 0.21 | 2.16 | 3.82 | 6.0 |
| | 27-65 | | 72.0 | 8.90 | 19.90 | 5.6 | 0.21 | 2.2 | 0.44 | 0.021 | 0.033 | 0.19 | 2.92 | 3.99 | 6.95 |
| | 65-90 | | 70.50 | 7.10 | 20.40 | 6.1 | 0.19 | 2.6 | 0.56 | 0.001 | 0.024 | 0.25 | 2.8 | 5.53 | 8.35 |
| Kanksa | 0-22 | 22.63 | 56.37 | 10.0 | 11.0 | 5.2 | 0.52 | 1.98 | 0.43 | 0.051 | 0.014 | 0.11 | 1.16 | 2.38 | 6.35 |
| | 22-62 | 19.73 | 37.73 | 14.48 | 28.80 | 5.2 | 0.41 | 3.66 | 0.43 | 0.032 | 0.018 | 0.26 | 2.72 | 6.24 | 6.35 |
| | 62-87 | 20.42 | 32.99 | 14.60 | 31.90 | 5.8 | 0.29 | 4.4 | 0.93 | 0.014 | 0.025 | 0.26 | 3.98 | 6.56 | 8.98 |
| | 87-150 | 18.96 | 32.99 | 12.81 | 35.76 | 5.9 | 0.15 | - | 0.39 | 0.012 | - | - | - | - | - |

Contd...

**Table 4.7 (Contd.)**

| Name of the P.S. | Depth in Cm. | Sand Coarse | Sand Fine | Silt | Clay | pH | Organic carbon | Airdry moisture | Calcium carbonate | Nitrogen | Phosphosur | Potassium | Ferrous oxide | Allumina | Sesqui oxide |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ausgram | 0-15 | 34.5 | | 30.0 | 35.5 | 6.9 | 0.60 | 4.9 | 2.39 | 0.071 | 0.02 | 0.49 | 4.8 | | 16.0 |
| | 15-70 | 32.5 | | 27.0 | 42.5 | 7.5 | 0.31 | 5.7 | 2.66 | 0.035 | 0.04 | 0.58 | 4.6 | | 19.0 |
| | 70-150 | 31.5 | | 23.0 | 45.5 | 7.6 | 0.27 | 6.0 | 3.33 | 0.027 | 0.05 | 0.70 | 5.3 | | 18.1 |
| Galsi | 0 - 10 | 43.3 | | 35.9 | 20.8 | 6.0 | 0.380 | 3.1 | 0.40 | 0. 058 | 0.038 | 0.41 | 4.56 | | 13.48 |
| | 10- 36 | 13.9 | | 26.8 | 49.3 | 5.1 | 0.212 | 5.0 | 0.47 | 0.030 | 0.023 | 0.68 | 5.52 | | 16.96 |
| | 36 - 69 | 24.7 | | 23.0 | 52.3 | 6.8 | 0.128 | 5.5 | 0.41 | 0.021 | 0.032 | 0.91 | 6.16 | | 18.7 |
| Khandaghosh | 0 - 15 | 48.39 | | 26.43 | 25.18 | 6.4 | 0.59 | 4.2 | 0.93 | 0.065 | 0.05 | 0.60 | 4.2 | 2.2 | 6.4 |
| | 15 - 48 | 48.03 | | 25.0 | 26.24 | 6.2 | 0.36 | 3.6 | 0.43 | 0.038 | 0.03 | 0.61 | 4.3 | 2.5 | 6.8 |
| | 48 - 71 | 63.0 | | 13.0 | 23.50 | 6.3 | 0.19 | 4.8 | 0.43 | 0.018 | 0.029 | 0.72 | 4.1 | 2.4 | 6.5 |
| | 71 - 101 | 47.81 | | 21.25 | 30.50 | 6.3 | 0.19 | - | 0.43 | 0.016 | | | | | |
| Raina | 0 - 10 | 16.3 | 25.3 | 17.3 | 41.1 | 5.3 | 0.49 | 1.3 | 0.9 | 0.09 | 0.05 | 0.15 | 4.4 | 9.95 | 14.5 |
| | 10 - 40 | 8.2 | 16.6 | 25.6 | 49.6 | 7.2 | 0.25 | 1.0 | 1.1 | 0.05 | 0.04 | 0.35 | 3.3 | 12.87 | 16.6 |
| | 40 - 60 | 8.5 | 10.7 | 27.7 | 53.1 | 7.3 | 0.14 | 3.1 | 1.4 | 0.02 | 0.03 | 0.23 | 7.6 | 12.05 | 19.8 |
| | 60-70 | 9.4 | 8.1 | 29.3 | 53.2 | 7.4 | 0.18 | 2.5 | 2.4 | 0.01 | 0.02 | 0.14 | 7.12 | 12.03 | 19.79 |
| Jamalpur | 0 - 6 | 4.7 | 78.8 | 10.4 | 3.8 | 6.5 | 0.24 | 2.1 | 0.7 | 0.02 | 0.03 | 0.06 | 2.1 | 2.7 | 5.8 |
| | 6 - 14 | 8.2 | 75.5 | 12.5 | 3.8 | 7.0 | 0.15 | 2.0 | 0.65 | 0.02 | 0.04 | 0.05 | 2.7 | 3.2 | 5.9 |
| | 14 - 30 | 11.68 | 61.85 | 8.53 | 13.88 | 7.0 | 0.16 | 1.09 | - | 0.035 | - | 0.03 | | | |
| Memari | 0 - 15 | 71.3 | | 10.0 | 18.7 | 4.7 | 0.45 | 1.80 | 0.69 | 0.044 | 0.059 | 0.08 | 3.58 | 2.39 | 6.03 |
| | 15 - 42 | 72.3 | | 10.0 | 10.0 | 6.6 | 0.28 | 2.3 | 0.69 | 0.022 | 0.15 | 0.03 | 4.32 | 5.18 | 9.64 |
| | 42-110 | 31.3 | | 20.0 | 48.7 | 6.8 | 0.21 | 1.5 | 0. 93 | 0.018 | 0.15 | 0.02 | 4.72 | 5.02 | 9.89 |
| | 110 - 150 | 46.3 | | 18.0 | 35.7 | 7.7 | 0.10 | 0.78 | 1.39 | 0.009 | 0.05 | 0.26 | 6.75 | 7.81 | 14.61 |
| Burdwan | 0 - 20 | 15.65 | 36.30 | 28.43 | 19.62 | 4.9 | 0.47 | 3.59 | 0.43 | 0.052 | 0.06 | 0.275 | 3.2 | 5.82 | 9.02 |
| | 20 - 60 | 11.88 | 22.10 | 27.0 | 39.50 | 6.0 | 0.29 | 3.91 | 0.43 | 0.026 | 0.03 | 0.50 | 4.0 | 7.92 | 11.92 |
| | 60 - 100 | 8.05 | 39.54 | 25.80 | 25.85 | 6.6 | 0.23 | 5.36 | 0.43 | 0.021 | 0.039 | 0.50 | 7.10 | 6.56 | 13.92 |
| | 100 - 150 | 9.43 | 44.04 | 23.95 | 22.20 | 6.6 | 0.17 | 6.34 | 0.93 | 0.014 | 0.039 | 0.50 | 4.8 | 7.6 | 12.40 |
| Bhatar | 0 - 10 | 12.57 | 33.08 | 20.50 | 33.85 | 4.5 | 0.705 | 2.05 | 0.39 | 0.056 | 0.024 | 0.43 | 4.4 | 7.2 | 11.6 |
| | 10 - 25 | 10.71 | 19.22 | 24.50 | 44.75 | 5.5 | 0.311 | 2.20 | 0.44 | 0.038 | 0.027 | 0.78 | 6.08 | 7.88 | 13.96 |
| | 25 - 55 | 8.21 | 17.07 | 24.15 | 50.0 | 5.7 | 0.255 | 3.2 | 0.56 | 0.021 | 0.023 | 0.98 | 6.20 | 13.64 | 19.84 |
| | 55 - 130 | 7.92 | 17.41 | 22.55 | 51.50 | 5.8 | 0.180 | 3.3 | 0.93 | 0.010 | 0.028 | 0.73 | 6.44 | 13.12 | 19.56 |

**TABLE 4.7 (Contd.)**

| Name of the P.S. | Depth in Cm. | Sand Coarse | Sand | Sand Fine | Silt | Clay | pH | Organic carbon | Airdry moisture | Calcium carbonate | Nitrogen | Phosphorus | Potassium | Ferrous oxide | Allumina | Sesqui oxide |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mengalkote | 0 - 16 | 10.88 | | 40.26 | 22.78 | 26.08 | 5.2 | 0.551 | 5.8 | 1.39 | 0.055 | 0.065 | 0.58 | 4.9 | 10.84 | 15.8 |
| | 16 - 31 | 4.44 | | 33.01 | 20.05 | 42.05 | 6.5 | 0.262 | 6.0 | 1.39 | 0.046 | 0.037 | 0.44 | 4.7 | 10.55 | 15.3 |
| | 31 - 53 | 6.86 | | 51.48 | 11.75 | 29.30 | 6.9 | 0.178 | 6.3 | 2.33 | 0.041 | 0.037 | 0.60 | 4.8 | 11.75 | 16.6 |
| | 53-94 | 6.36 | | 61 .32 | 7.0 | 24.15 | 7.0 | 0.116 | 5.6 | 2.33 | 0.035 | | 0.55 | 4.4 | 9.46 | 14.9 |
| Ketugram | 0 - 12 | 9.56 | | 37.44 | 25.5 | 27.5 | 5.1 | 0.49 | 2.5 | 0.46 | 0.048 | 0.083 | 0.39 | 3.30 | 5.75 | 9.14 |
| | 12 - 21 | 9.56 | | 37.44 | 26.5 | 26.5 | 6.1 | 0.30 | 3.6 | 0.69 | 0.04 | 0.056 | 0.66 | 3.80 | 9.58 | 13.44 |
| | 21 - 48 | 6.12 | | 22.88 | 20.5 | 50.5 | 7.0 | 0.14 | 4.2 | 1.39 | 0.04 | 0.042 | 0.63 | 4.0 | 9.55 | 13.6 |
| | 48 - 99 | 3.08 | | 26.92 | 24.5 | 45.5 | 6.7 | 0.13 | 4.3 | 1.39 | 0.03 | 0.042 | 0.74 | 4.60 | 11.18 | 15.83 |
| | 99 - 150 | 3.92 | | 26.08 | 27.5 | 42.5 | 6.4 | 0.097 | | 1.66 | 0.02 | | | | | |
| Katwa | 0 - 15 | | 50.3 | | 19.7 | 30.0 | 6.8 | 0.31 | 1.8 | 2.05 | 0.032 | 0.033 | 0.17 | 2.9 | 2.36 | 5.3 |
| | 15 - 30 | | 53.3 | | 20.7 | 26.0 | 7.4 | 0.28 | 1.5 | 2.33 | 0.027 | 0.021 | 0.22 | 2.5 | 4.77 | 7.3 |
| | 30 - 70 | | 77.3 | | 4.7 | 18.0 | 7.7 | 0.24 | 2.8 | 2.33 | 0.021 | 0.019 | 0.18 | 3.1 | 5.08 | 8.2 |
| | 70 - 150 | | 70.3 | | 19.7 | 10.0 | 8.0 | 0.14 | 4.0 | 3.14 | 0.010 | 0.021 | 0.28 | 4.0 | 7.58 | 11.6 |
| Monteswar | 0 - 6 | | 36.1 | | 26.0 | 37.9 | 5.6 | 0.44 | 2.6 | 0.48 | 0.064 | 0.044 | 0.28 | 4.3 | - | 11.4 |
| | 6 - 18 | | 28.1 | | 26.0 | 45.9 | 6.1 | 0.24 | 4.1 | 0.58 | 0.044 | 0.076 | 0.29 | 4.6 | - | 13.0 |
| | 18 - 28 | | 24.1 | | 28.0 | 47.9 | 6.5 | 0.18 | 4.1 | 0.58 | 0.037 | 0.026 | 0.46 | 4.7 | - | 16.1 |
| | 28 - 48 | | 24.1 | | 24.0 | 51.9 | 7.2 | 0.16 | 6.2 | 0.98 | 0.027 | 0.056 | 0.56 | 5.8 | - | 15.2 |
| Purbasthali | 0 - 13 | | 50.3 | | 21.7 | 28.0 | 6.0 | 0.31 | 6.5 | 1.39 | 0.050 | 0.074 | 0.95 | 7.84 | - | 23.74 |
| | 13 - 32 | | 46.3 | | 21.7 | 32.0 | 5.9 | 0.30 | 6.7 | 0.93 | 0.025 | 0 .056 | 0.96 | 7.92 | - | 25.05 |
| | 32 - 50 | | 71.3 | | 8.7 | 20.0 | 5.9 | 0.22 | 2.9 | 1.39 | 0.016 | 0.029 | 0.55 | 3.6 | - | 13.08 |
| Kalna | 0 - 12 | | 28.70 | | 42.0 | 29.3 | 7.7 | 0.49 | 3.1 | 2.33 | 0.054 | 0.06 | 0.4 | 3.94 | 7.77 | 11.71 |
| | 12 - 46 | | 49.70 | | 28.0 | 22.3 | 7.5 | 0.26 | 4.6 | 2.05 | 0.028 | 0.04 | 0.42 | 4.89 | 10.10 | 15.9 |
| | 46 - 88 | | 64.70 | | 19.0 | 16.3 | 7.8 | 8.25 | 4.0 | 1.65 | 0.022 | 0.035 | 0.50 | 4.65 | 8.09 | 12.8 |
| | 88 - 150 | | 39.70 | | 36.0 | 24.3 | 7.6 | 0.14 | 7.7 | 2.33 | 0.014 | 0.06 | 0.51 | 7.93 | 17.03 | 25.0 |

Source : Soil and Land Use Survey, ICAR, Calcutta.

## TABLE 4.8

Underground water level in the District of Burdwan

| Name of the P.S. | Name of the Village | Depth of water level in metres | |
|---|---|---|---|
| | | Summer | Winter |
| Salanpur | Madhaichak | 15.22 | |
| | Bolkunda | 6.21 | |
| | Shyamdi | 5.76 | |
| Kulti | Manberia | 3.0 | |
| | Chalbalpur | 20.0 | 11.74 |
| | Shibpur | 7.97 | 5.59 |
| | Barakar | 4.05 | |
| | Nedmatpur | 8.72 | 2.11 |
| | Methani | 8.83 | ~~1.78~~ |
| Hirapur | Hirapur | 3.58 | 1.78 |
| Asansol | Asansol | 9.98 | 2.67 |
| | Barachak | | 3.47 |
| | Kalla | | 4.12 |
| Barabani | Bardanga | 3.58 | |
| | Lalganja | 15.09 | |
| | Kanyapur | 9.85 | |
| | Panchgochia | 4.62 | |
| | Madanpur | 10.93 | |
| | Majiyara | 16.22 | |
| | Barabani | 11.12 | |

TABLE 4.8 (Contd.)

| Name of the P.S. | Name of the Village | Depth of water level in metres | |
|---|---|---|---|
| | | Summer | Winter |
| Jamuria | Shibpur | 15.26 | |
| | Kundalia | 8.43 | |
| | Mithapur | 15.42 | |
| | Satgram | 5.91 | |
| | Bijoynagar | 7.93 | |
| | Tapasi | 19.22 | |
| Raniganj | Chalbalpur | 4.86 | |
| | Belebathan | 21.70 | |
| | Raniganj | 11.16 | |
| | Ballavpur | 5.55 | |
| | Baktarnagar | 2.33 | |
| Andal | Ukhra | 6.19 | |
| | Babula | 4.39 | |
| | Khandra | 8.10 | |
| | Dakshinkhanda | 5.19 | |
| | Kajora | 10.73 | |
| | Palashban | 4.72 | |
| | Andal | 8.51 | |
| | Tamla | 2.44 | |
| Faridpur | Waria | 4.24 | |
| | Faridpur | 1.26 | |
| | Sankarpur | 9.20 | |
| | Madhaipur | 10.5 | |
| | Sarpi | 1.52 | |
| | Joalbhanga | 4.23 | |
| | Benachiti | 6.98 | |
| | Laudoha | | 4.02 |
| | Protapur | | 3.87 |

TABLE 4.8 (Contd.)

| Name of the P.S. | Name of the Village | Depth to water level in metres | |
|---|---|---|---|
| | | Summer | Winter |
| | Nabaghanpur | | 3.87 |
| | Ichapur | | 4.59 |
| | Parulia | | 10.95 |
| | Bhiriggi | | 2.39 |
| | Bishtupur | | n5.82 |
| Kanksa | Banagram | | 9.74 |
| | Nabagram | | 6.42 |
| | Raghunathpur | | 3.29 |
| | Malandighi | 8.30 | |
| | Kuldiha | | 5.65 |
| | Rupganj | | 11.63 |
| | Bamunara | | 7.60 |
| | Mobarakganj | | 6.99 |
| | Keshabpur | | 5.81 |
| Budbud | Gobindapur | | 5.55 |
| | Bharatpur | | 7.22 |
| | Budbud | 7.85 | |
| | Maro | | 7.28 |
| | Mankar | | 2.90 |
| | Kalyanpur | | 10.10 |
| Ausgram | Ramchandrapur | | 3.53 |
| | Maliara | | 3.05 |
| Galsk | Paraj | 7.53 | |
| | Galsi | 9.93 | |
| | Gopalpur | 19.4 | |
| | Shyamsundarpur | | 2.92 |
| | Dharampur | 22.38 | |

TABLE 4.8 (Contd.)

| Name of the P.S. | Name of the Village | Depth to water level in metres Summer | Winter |
|---|---|---|---|
| Raina | Babarakpur | 6.7 | |
| | Sugrai | 3.87 | |
| | Phalanpur | 5.46 | |
| Jamalpur | Krishnachandrapur | 1.78 | |
| | Masagram | 3.72 | |
| | Sanchra | 4.56 | |
| Memari | Malamba | 10.46 | |
| | Ausa | 6.61 | |
| | Kuchut | 6.95 | |
| | Mamudpur | 7.83 | |
| | Ranihati | 3.69 | |
| | Mashagaria | 3.16 | |
| | Khanrgram | 4.88 | |
| | Palsit | 2.83 | |
| | Chachai | 4.12 | |
| | Belut | 3.28 | |
| | Mahishdanga | 3.04 | |
| | Parhati | 3.90 | |
| | Balidanga | 2.45 | |
| | Kenna | | 2.23 |
| | Nimo | | 2.84 |
| | Memari | | 2.27 |
| | Kharo | | 3.89 |
| | Bagila | | 2.41 |
| | Tajpur | 3.58 | |
| | Andur | 3.43 | |
| | Jotchaitanya | 3.25 | |
| | Gobindapur | 3.65 | |
| | Amudpur | | 2.58 |

TABLE 4.8 (contd.)

| Name of the P.S. | Name of the Village | Depth to water level in metres Summer | Winter |
|---|---|---|---|
| Burdwan | Amara | | 3.70 |
| | Alamgunj | 2.46 | |
| | Ichlabad | 4.26 | |
| | Gangpur | | 4.76 |
| | Saktigarh | 2.90 | |
| | Sadarghat | 6.18 | |
| | Birhata | 4.43 | |
| | Kammara | 9.26 | |
| | Kurman | 6.25 | |
| | Palashi | 7.84 | |
| | Mirzapur | 7.03 | |
| | Bandul | 5.23 | |
| Bhatar | Daura | 3.08 | |
| | Banpas | 8.39 | |
| | Mahata | 5.85 | |
| | Nutangram | 5.85 | |
| | Baktar | 9.83 | |
| | Nashigram | 10.46 | |
| Mongalkote | Gobindapur | 6.88 | |
| Monteswar | Bhojpur | 6.39 | |
| | Gopabnagar | 4.99 | |
| | Tulla | 6.05 | |
| | Monteswar | 8.37 | |
| | Sahazadpur | 4.53 | |
| | Kaigram | 7.50 | |
| | Bheli | 4.02 | |
| | Piplun | 6.18 | |

TABLE 4.8 (Contd.)

| Name of the P.S. | Name of the Village | Depth to water level in metres Summer | Winter |
|---|---|---|---|
| Purbasthali | Satgachia | 3.05 | |
| | Arjunpukur | 5.46 | |
| | Madhupur | 5.31 | |
| | Nawapara | 6.47 | |
| | Purbasthali | 10.74 | |
| | Jahannagar | 10.16 | |
| | Dharmata | 7.97 | |
| | Khahgaria | 7.65 | |
| | Bhatsala | 8.25 | |
| | Malatipur | 8.02 | |
| | Dakshinbati | 7.93 | |
| | Samudragarh | 8.54 | |
| | Simjuli | 8,28 | |
| | Nadanghat | 9.65 | |
| Kalna | Taipara | 3.20 | |
| | Rasulpur | 3.80 | |
| | Ranibandh | 4.13 | |
| | Gola | | |
| | Simba | | 3.40 |
| | Digha | 3.07 | |
| | Guptipur | 4.18 | |
| | Sankati | 4.56 | |
| | Navpara | 3.29 | |
| | Sargaria | 6.85 | |
| | Briddhapara | 5.82 | |
| | Medagachi | 3.39 | |
| | Singrail | | 3.41 |
| | Patharghata | 7.06 | |

Source : Central Ground Water Board, Calcutta.

**TABLE 5.1**

Agricultural land use during 1905-06 to 1967-68

**(Area in hectares)**

| Year | Net cropped area | Current fallow land | Area sown more than once |
|---|---|---|---|
| 1905-6 | 393093.0 | 98156.0 | |
| 1906-7 | 384790.5 | 106873.0 | |
| 1907-8 | 384345.0 | 107321.0 | |
| 1908-9 | 400180.5 | 91485.5 | |
| 1909-10 | 388111.5 | 103554.5 | |
| 1910-11 | 343723.5 | 147942.5 | |
| 1911-12 | 343723.5 | 147942.5 | |
| 1912-13 | 328050.0 | 163717.0 | |
| 1913-14 | 341212.5 | 150554.5 | |
| 1914-15 | 335623.5 | 156143.5 | |
| 1915-16 | 233766.0 | 258001.0 | |
| 1916-17 | 247009.5 | 244757.5 | |
| 1917-18 | 306139.5 | 185627.5 | |
| 1918-19 | 286780.5 | 204986.5 | |
| 1919-20 | 311323.5 | 180443.5 | |
| 1920-21 | 289818.0 | 207971.5 | 83977.5 |
| 1921-22 | 266652.0 | 225115.0 | 89100.0 |
| 1922-23 | 356643.0 | 175218.0 | 14701.5 |
| 1923-24 | 329751.0 | 105220.5 | 14701.5 |
| 1924-25 | 338701.5 | 157618.0 | 10813.5 |

Table 5.1(contd.)

| Year | Net cropped area | Current fallow land | Area sown more than once |
|---|---|---|---|
| 1925-26 | 342630.0 | 157582.0 | 11461.5 |
| 1926-27 | 347085.0 | 157575.0 | 11016.5 |
| 1927-28 | 220644.0 | 179216.0 | 5953.0 |
| 1928-29 | 340645.5 | 119214.5 | 16443.0 |
| 1929-30 | 291316.5 | 156601.0 | 16443.0 |
| 1930-31 | 221575.5 | 226342.0 | 85708.0 |
| 1931-32 | 233239.5 | 158124.0 | 67311.0 |
| 1932-33 | 236358.0 | 155005.5 | 49612.0 |
| 1933-34 | 277951.5 | 146003.0 | 10085.0 |
| 1934-35 | 195655.5 | 215884.0 | 6480.0 |
| 1935-36 | 187717.5 | 223822.0 | 4576.5 |
| 1936-37 | 266321.0 | 165218.5 | 25839.0 |
| 1937-38 | 219429.0 | 192110.5 | 24624.0 |
| 1938-39 | 236520.0 | 196074.0 | 23692.5 |
| 1939-40 | 236925.0 | 195668.5 | 34344.0 |
| 1940-41 | 175527.0 | 257067.0 | 47587.5 |
| 1941-42 | 293058.0 | 139536.0 | 30375.0 |
| 1942-43 | 218052.0 | 262440.0 | 10935.0 |
| 1943-44 | 279551.0 | 208271.0 | 18326.0 |
| 1944-45 | 295462.5 | 174265.0 | 20225.0 |

Table 5.1 (contd.)

| Year | Net cropped area | Current fallow land | Area sown more than once |
|---|---|---|---|
| 1945-46 | 341050.5 | 154102.5 | 25717.5 |
| 1946-47 | 464656.5 | 32643.0 | 24826.5 |
| 1947-48 | 465385.5 | 29929.5 | 23247.0 |
| 1948-49 | 460525.5 | 40621.5 | 20614.5 |
| 1949-50 | 478102.5 | 23611.5 | 20695.5 |
| 1950-51 | 470853.0 | 24300.0 | 27722.0 |
| 1951-52 | 449388.0 | 45886.5 | 34749.0 |
| 1952-53 | 480127.5 | 23328.0 | 33615.0 |
| 1953-54 | 489645.0 | 15390.0 | 38272.5 |
| 1954-55 | 481383.0 | 23490.0 | 31590.0 |
| 1955-56 | 486323.0 | 18306.0 | 33939.0 |
| 1956-57 | 484258.5 | 22078.0 | 33615.0 |
| 1957-58 | 479000.0 | 26600.0 | 29100.0 |
| 1958-59 | 471600.0 | 34000.0 | 28400.0 |
| 1959-60 | 485037.0 | 22224.5 | 32020.0 |
| 1960-61 | 498474.0 | 10449.0 | 35640.0 |
| 1961-62 | 497745.0 | 10894.5 | 33534.0 |
| 1962-63 | 495477.0 | 11826.0 | 32805.0 |
| 1963-64 | 489969.0 | 16524.0 | 27378.0 |
| 1964-65 | 504225.0 | 10290.0 | 47142.0 |
| 1965-66 | 492115.5 | 16645.5 | 40459.5 |
| 1966-67 | 490900.5 | 17820.0 | 31225.5 |
| 1967-68 | 500377.5 | 8019.0 | 42525.0 |

**TABLE 5.2**

Land Utilisation in Burdwan District (1970-71)

(Area in hectares)

| | Total area of the P.S. | Area of the forests | Net sown area | Irrigated area | Cultivated waste land | Area not available for cultivation | Unirrigated area | Other areas |
|---|---|---|---|---|---|---|---|---|
| Chittaranjan | 490.86 | 0 | 40.50 | 0 | 2.02 | 174.15 | 0 | 274.19 |
| Salanpur | 11323.39 | 0 | 3171.96 | 0 | 226.39 | 1187.86 | 0 | 6737.18 |
| Kulti | 8419.0 | 0 | 3241.61 | 253.93 | 372.19 | 2523.55 | 2987.68 | 2281.65 |
| Hirapur | 6369.0 | 0 | 1424.79 | 276.21 | 923.40 | 1496.88 | 1148.58 | 2523.93 |
| Asansol | 6904.0 | 0 | 2685.15 | 19.44 | 652.05 | 2971.75 | 2665.71 | 2995.05 |
| Barabani | 15428.0 | 1239.30 | 8639.46 | 1495.26 | 925.42 | 4550.58 | 7144.20 | 73.24 |
| Jamuria | 23471.0 | 50.62 | 10793.25 | 0 | 1619.59 | 10360.30 | 10793.25 | 647.24 |
| Ranigunj | 8512.0 | 64.80 | 3368.79 | 135.27 | 1398.87 | 2643.84 | 3233.52 | 1035.70 |
| Andal | 11711.0 | 0 | 4369.54 | 57.91 | 775.17 | 5433.07 | 4311.63 | 1133.22 |
| Faridpur | 21353.62 | 850.0 | 10082.07 | 2029.05 | 1656.85 | 8764.65 | 8053.02 | 0 |
| Durgapur | 16802.64 | 211.81 | 653. 67 | 40.50 | 25.11 | 27.13 | 613.17 | 15884.92 |
| Kanksa | 28202.17 | 5934.87 | 8541.04 | 1933.06 | 7053.07 | 4578.93 | 6607.98 | 2094.26 |
| Budbud | 19776.96 | 1147.36 | 9212.72 | 2683.12 | 4350.42 | 5066.46 | 6529.85 | 0 |
| Ausgram | 50039.37 | 7314.30 | 34725.51 | 18761.22 | 1866.64 | 6132.92 | 15964.29 | 0 |
| Galsi | 37332.90 | 0 | 30627.72 | 25538.49 | 405.40 | 6299.78 | 5089.23 | 0 |
| Khandaghosh | 26056.0 | 10.12 | 18257.40 | 14729.04 | 133.24 | 7655.24 | 3528.36 | 0 |
| Raina | 47893.0 | 47.79 | 38673.04 | 24408.54 | 842.40 | 8329.54 | 14264.50 | 0 |
| Jamalpur | 26313.0 | 0 | 19192.54 | 9811.93 | 1767.01 | 5065.74 | 9380.61 | 287.71 |
| Memari | 42740.0 | 0 | 35130.51 | 27801.63 | 441.85 | 5706.04 | 7328.88 | 1461.60 |
| Burdwan | 40720.0 | 0 | 28639.98 | 23127.12 | 765.13 | 9519.93 | 5512.86 | 1803.96 |
| Bhatar | 41708.0 | 266.08 | 30494.54 | 26412.14 | 336.96 | 10300.77 | 4082.40 | 309.65 |
| Mongalkote | 36532.0 | 0 | 29087.90 | 17756.41 | 760.63 | 5667.16 | 11331.49 | 1016.31 |
| Ketugram | 35340.0 | 0 | 28853.81 | 14512.36 | 1422.76 | 5063.43 | 14341.45 | 0 |
| Katwa | 34232.0 | 25.92 | 25378.51 | 11147.62 | 694.17 | 6180.70 | 14230.89 | 1952.70 |
| Monteswar | 30590.0 | 0 | 24117.75 | 15905.97 | 490.05 | 5930.82 | 8211.78 | 51.38 |
| Purbasthali | 34070.0 | 0 | 23411.43 | 4567.59 | 319.95 | 10338.62 | 18843.84 | 0 |
| Kalna | 34433.91 | 17.41 | 26074.30 | 10876.68 | 733.05 | 7266.91 | 15197.62 | 342.24 |

[ Source : 1971 Census of Burdwan ]

## TABLE 5.3

Area (in hectares) irrigated by different sources in Burdwan Dist.

| Year | Canal Government | Canal Private | Tanks | Wells | Others | Total |
|---|---|---|---|---|---|---|
| 1947-48 | 77069 | 202.5 | 40500 | 607.5 | 8100 | 126479 |
| 1948-49 | 77170 | 202.5 | 40500 | 607.5 | 8100 | 126580 |
| 1949-50 | 78928 | 486.0 | 32254 | 1620 | 11461 | 124749 |
| 1950-51 | 78470 | 486 | 32254 | 1620 | 18232 | 131062 |
| 1951-52 | 81210 | 18504 | 40540 | 1620 | 20290 | 162164 |
| 1952-53 | 83081 | 20250 | 40824 | 1620 | 20290 | 166065 |
| 1953-54 | 82134 | 20250 | 40905 | 1620 | 20290 | 165199 |
| 1954-55 | 82093 | 19440 | 40500 | 1012 | 19966 | 162000 |
| 1955-56 | 89748 | 20250 | 40905 | 1215 | 20250 | 172368 |
| 1956-57 | 92745 | 20331 | 41026 | 1296 | 20371 | 175769 |
| 1957-58 | 123282 | 19359 | 38961 | 1012 | 18670 | 201284 |
| 1958-59 | 151834 | 18468 | 37989 | 1255 | 18832 | 228378 |
| 1959-60 | 172000 | 18000 | 35600 | 1220 | 18900 | 245720 |
| 1960-61 | 187400 | 17400 | 34400 | 1200 | 19100 | 259500 |
| 1961-62 | 190500 | 17400 | 34000 | 1200 | 19000 | 262100 |
| 1962-63 | 200000 | 17500 | 33500 | 1250 | 19000 | 271250 |
| 1963-64 | 205000 | 17600 | 33200 | 1250 | 18800 | 275850 |
| 1964-65 | 218500 | 17600 | 33200 | 1300 | 18600 | 289200 |
| 1965-66 | 223800 | 12100 | 31700 | 1200 | 18600 | 287400 |
| 1966-67 | 227500 | 11300 | 31500 | 1000 | 19600 | 290900 |
| 1967-68 | 231100 | 11300 | 31200 | 800 | 21700 | 296100 |
| 1968-69 | 231295 | 11340 | 31185 | 810 | 21667 | 296297 |
| 1969-70 | 240700 | - | - | 51840 | | 292540 |
| 1970-71 | 257400 | - | | 65190 | | 322590 |
| 1971-72 | 274362 | - | | 75860 | | 350222 |
| 1972-73 | 268900 | - | | 104990 | | 373890 |
| 1973-74 | 286600 | - | | 127940 | | 414540 |
| 1974-75 | 300696 | - | | 87760 | | 388456 |
| 1975-76 | 304271 | - | | 41130 | | 345401 |
| 1976-77 | 319747 | - | | 46150 | | 365897 |
| 1977-78 | 298900 | - | | - | | |

[Source : Season and Crop Reports Statistical Abstract ]

## TABLE 5.4

Irrigated area (in hectares) in the Police Stations of Burdwan (1971)

| Name of the P.S. | Canal (C) | Tank (TK) | Well (W) | Tube-Well (TW) | Deep TubeWell (TWB) | River (R) | Total |
|---|---|---|---|---|---|---|---|
| Chittaranjan | - | - | - | - | - | - | - |
| Salanpur | - | - | - | - | - | - | - |
| Kulti | - | 254.0 | - | - | - | - | 254.0 |
| Hirapur | - | 274.2 | 2.0 | - | - | - | 276.2 |
| Asansol | - | 19.4 | - | - | - | - | 19.4 |
| Barabani | - | 1495.3 | - | - | - | - | 1495.3 |
| Jamuria | - | - | - | - | - | - | - |
| Raniganj | - | 135.3 | - | - | - | - | 135.3 |
| Andal | - | 57.9 | - | - | - | - | 57.9 |
| Faridpur | - | 2022.1 | - | - | - | - | 2022.1 |
| Durgapur | - | 88.3 | - | - | - | - | 88.3 |
| Kanksa | 750.0 | 792.2 | 142.6 | - | - | 152.3 | 1837.1 |
| Budbud | 2361.5 | - | - | - | 226.8 | 94.8 | 2683.1 |
| Ausgram | 11041.9 | 5776.9 | - | - | 6.1 | 828.2 | 17653.1 |
| Galsi | 25491.9 | 12.1 | - | 5.7 | - | 28.7 | 25538.4 |
| Khandaghosh | 13679.3 | 381.5 | - | - | 587.2 | 8.1 | 14656.1 |
| Raina | 24408.5 | - | - | - | - | - | 24408.5 |
| Jamalpur | 9649.9 | - | - | - | - | 162.0 | 9649.9 |
| Memari | 25634.1 | 744.0 | - | 164.4 | 188.7 | 1042.4 | 27773.6 |
| Burdwan | 20614.5 | 1357.6 | - | - | - | 1174.1 | 23146.2 |
| Bhatar | 25395.1 | 1125.0 | - | - | - | 48.6 | 26568.7 |
| Mongalkote | 16739.5 | 931.9 | - | 24.3 | - | 60.7 | 17756.4 |
| Ketugram | 13045.0 | 1018.6 | - | 10.1 | - | 222.3 | 14296.0 |
| Katwa | 7463.7 | 1445.4 | - | 235.3 | 703.1 | 1025.0 | 10872.5 |
| Monteswar | 15815.6 | - | - | 4.0 | | 137.7 | 15957.3 |
| Purbasthali | - | 407.4 | 16.2 | 993.5 | 2227.1 | 838.3 | 4482. 5 |
| Kalna | 6494.2 | 2232.4 | - | 65.6 | 534.6 | 1407.4 | 10734.2 |

TABLE 5.5

| Name of the P.S. | Geographical area | Net sown area | Net sown area as percentage to geographical area |
|---|---|---|---|
| Salanpur | 13495.5 | 3374.06 | 24.81 |
| Kulti | 8547,3 | 4368.33 | 51.10 |
| Hirapur | 6367.5 | 1900.19 | 29.84 |
| Asansol | 5179.8 | 1003.15 | 19.37 |
| Barabani | 15638.8 | 7492.50 | 47.91 |
| Jamuria | 23305.9 | 10381.36 | 44.54 |
| Raniganj | 8783.6 | 1168.42 | 13.30 |
| Andal | 18311.5 | 5095.88 | 27.83 |
| Faridpur | 21793.1 | 9067.25 | 41.61 |
| Kanksa | 28180.1 | 8727.75 | 30.97 |
| Ausgram | 59733.7 | 36593.77 | 61.26 |
| Galsi | 44776.0 | 31218.21 | 69.72 |
| Khandaghosh | 26035.2 | 20650.30 | 79.31 |
| Raina | 48624.7 | 39082.60 | 80.38 |
| Jamalpur | 27103.2 | 21465.0 | 79.20 |
| Memari | 44132.9 | 35909.32 | 81.37 |
| Burdwan | 40690.2 | 26739.35 | 65.71 |
| Bhatar | 43221.9 | 31311.58 | 72.44 |
| Mongalkote | 36587.3 | 24806.25 | 67.80 |
| Ketugram | 35095.6 | 25153.74 | 71.67 |
| Katwa | 33214.9 | 24560.25 | 73.94 |
| Monteswar | 30206.8 | 25630.42 | 84.85 |
| Purbasthalk | 35002.5 | 24844.72 | 71.09 |
| Kalna | 34002.1 | 26041.50 | 76.59 |

TABLE 5.6

| Name of the P.S. | Gross cultivated land (hect.) (G) | Net cultivated land (hect) (N) | Potential cultivable land (%) $\left[1 - \frac{N}{G} \times 100\right]$ |
|---|---|---|---|
| Salanpur | 3951.52 | 3374.06 | 36 |
| Kulti | 4520.20 | 4368.33 | 33 |
| Hirapur | 2577.42 | 1900.19 | 11 |
| Asansol | 1349.26 | 1003.15 | 5 |
| Barabani | 7692.97 | 7492.30 | 24 |
| Jamuria | 11806.96 | 10381.36 | 33 |
| Ranigunj | 1473. 38 | 1168.42 | 66 |
| Andal | 5379.38 | 5095.88 | 28 |
| Faridpur | 14004.90 | 9067.25 | 50 |
| Kanksa | 11647.39 | 8727.75 | 27 |
| Auggram | 41817.46 | 36593.77 | 32 |
| Galsi | 53278.96 | 31218.21 | 49 |
| Khandaghosh | 34795.48 | 20650.30 | 41 |
| Raina | 46352.35 | 39082.60 | 39 |
| Jamalpur | 38584.35 | 21465.0 | 14 |
| Memari | 62432.77 | 35909.32 | 32 |
| Burdwan | 44685.92 | 26739.35 | 43 |
| Bhatar | 43279.33 | 31311.58 | 47 |
| Mongalkote | 30800.25 | 24806.25 | 40 |
| Ketugram | 31376.56 | 25153.74 | 28 |
| Katwa | 37224.60 | 24560.25 | 11 |
| Monteswar | 31610.65 | 25630.42 | 47 |
| Purbasthali | 37642.72 | 24844.72 | 28 |
| Kalna | 37620.45 | 26041.50 | 15 |

TABLE 5.7

Total population and agricultural workers in different Police Stations of Burdwan

| Name of the P.S. | Total population | Agricultural workers | Agricultural workers percentages to total population of the P.S. |
|---|---|---|---|
| Chittaranjan | 42965 | 166 | 0.39 |
| Salanpur | 48734 | 7781 | 15.97 |
| Kulti | 149533 | 4304 | 2.88 |
| Hirapur | 107207 | 2675 | 2.49 |
| Asansol | 206762 | 5836 | 2.82 |
| Barabani | 63912 | 9573 | 14.98 |
| Jamuria | 143419 | 15702 | 10.95 |
| Raniganj | 121044 | 4435 | 3.66 |
| Andal | 125358 | 6134 | 4.89 |
| Faridpur | 82690 | 11358 | 13.73 |
| Durgapur | 211000 | 5369 | 2.54 |
| Kanksa | 77628 | 14726 | 18.97 |
| Budbud | 58398 | 11081 | 18.97 |
| Ausgram | 152010 | 36424 | 23.96 |
| Galsi | 150543 | 35333 | 23.47 |
| Khandaghosh | 105083 | 22087 | 21.02 |
| Raina | 196005 | 39904 | 20.36 |
| Jamalpur | 139641 | 33264 | 23.82 |
| Memari | 217851 | 51707 | 23.75 |
| Burdwan | 300215 | 37636 | 12.54 |
| Bhatar | 153945 | 34057 | 22.12 |
| Mongalkote | 154887 | 32776 | 21.16 |
| Ketugram | 161945 | 32593 | 20.13 |
| Katwa | 215662 | 36574 | 16.96 |
| Monteswar | 134345 | 28190 | 20.98 |
| Purbasthali | 182306 | 35317 | 19.37 |
| Kalna | 213076 | 44476 | 20.87 |

[ Source - 1971 Census of Burdwan ]

**TABLE 5.8**

**Agricultural Density**

| Name of the P.S. | Cultivated area (in acre) | Agricultural worker | Agricultural density (persons per acre) |
|---|---|---|---|
| Chittaranjan | 100 | 166 | 1.66 |
| Salanpur | 16837 | 7781 | 0.46 |
| Kulti | 9741 | 4304 | 0.44 |
| Hirapur | 4330 | 2675 | 0.62 |
| Asansol | 6678 | 5836 | 0.87 |
| Barabani | 25024 | 9573 | 0.38 |
| Jamuria | 26700 | 15702 | 0.59 |
| Raniganj | 8642 | 4435 | 0.51 |
| Andal | 11232 | 6134 | 0.55 |
| Faridpur | 29904 | 11358 | 0.38 |
| Durgapur | 1950 | 5369 | 2.75 |
| Kanksa | 34968 | 14726 | 0.42 |
| Budbud | 29370 | 11081 | 0.38 |
| Ausgram | 126624 | 36427 | 0.29 |
| Galsi | 137168 | 35333 | 0.26 |
| Khandaghosh | 81448 | 22087 | 0.27 |
| Raina | 157204 | 39904 | 0.24 |
| Jamalpur | 71616 | 33264 | 0.46 |
| Memari | 149087 | 51707 | 0.35 |
| Burdwan | 124979 | 37636 | 0.30 |
| Bhatar | 138246 | 34057 | 0.24 |
| Mongalkote | 115243 | 32776 | 0.28 |
| Ketugram | 106043 | 32593 | 0.31 |
| Katwa | 83194 | 36574 | 0.44 |
| Manteswar | 126105 | 28190 | 0.22 |
| Purbasthali | 93547 | 35317 | 0.38 |
| Kalna | 90901 | 44476 | 0.49 |

**TABLE 5.9**

Man-Soil Density of Burdwan $\left(\frac{\text{Total population of unit}}{\text{Total area (in acres) cultivated}}\right)$

| Name of the P.S. | Population | Cultivated area (in acres) | Man-soil density (persons/acre) |
|---|---|---|---|
| Salanpur | 91699 | 16937 | 5.41 |
| Kulti | 149533 | 9741 | 15.35 |
| Hirapur | 107207 | 4330 | 24.75 |
| Asansol | 206762 | 6678 | 30.96 |
| Barabani | 63912 | 25024 | 2.55 |
| Jaguria | 143419 | 26700 | 5.37 |
| Raniganj | 121044 | 8642 | 14.03 |
| Andal | 125358 | 11232 | 11.16 |
| Faridpur | 293690 | 31854 | 9.22 |
| Kanksa | 77628 | 34968 | 2.21 |
| Ausgram | 170688 | 137748 | 1.24 |
| Galsi | 190313 | 155418 | 1.22 |
| Khandaghosh | 105093 | 81448 | 1.29 |
| Raina | 196005 | 157204 | 1.24 |
| Jamalpur | 139641 | 71616 | 1.95 |
| Memari | 217851 | 149087 | 1.46 |
| Burdwan | 300215 | 124979 | 2.01 |
| Bhatar | 153945 | 138246 | 1.11 |
| Mongalkote | 154887 | 115243 | 1.34 |
| Ketugram | 161945 | 106043 | 1.53 |
| Katwa | 215662 | 83194 | 2.59 |
| Menteswar | 134345 | 126105 | 1.06 |
| Purbasthali | 182306 | 93547 | 1.44 |
| Kalna | 213076 | 90901 | 2.34 |

## TABLE 5.10

### Production (in quintal) of Crops

| Year | Aman Paddy | Aus Paddy | Boro Paddy | Wheat |
|---|---|---|---|---|
| 1947-48 | 3709608.0 | 210484.8 | 15674.4 | 7090.8 |
| 1948-49 | 3927402.0 | 221476.3 | 18571.4 | 13211.8 |
| 1949-50 | 4054071.6 | 208618.8 | 17279.2 | 13062.0 |
| 1950-51 | 5077386.0 | 119797.2 | 14928.0 | 20936.5 |
| 1951-52 | 4113071.0 | 143754.2 | 27229.0 | 26856.0 |
| 1952-53 | 4596143.3 | 256325.6 | 4028.0 | 10593.2 |
| 1953-54 | 6959844.3 | 254497.9 | 5818.8 | 24207.7 |
| 1954-55 | 5361315.5 | 331895.4 | 9325.0 | 32786.7 |
| 1955-56 | 5536439.0 | 218055.8 | 9809. 9 | 29168.6 |
| 1956-57 | 4847135.0 | 201047.0 | 14211.3 | 22342.7 |
| 1957-58 | 6136596.0 | 227418.1 | 18277.0 | 12047.9 |
| 1958-59 | 5409000.0 | 158000 | 19000 | 18000 |
| 1959-60 | 4837000.0 | 253000 | 34000 | 16000 |
| 1960-61 | 6655000 | 317000 | 26000 | 19000 |
| 1961-62 | 5861000 | 136000 | 24000 | 18000 |
| 1962-63 | 5620000 | 285000 | 27000 | 22000 |
| 1963-64 | 633000 | 234000 | 19000 | 31000 |
| 1964-65 | 6523000 | 291000 | 18000 | 24000 |
| 1965-66 | 6163000 | 271000 | 35000 | 28000 |
| 1966-67 | 5617000 | 240000 | 23000 | 33000 |

Contd...

Table 5.10 (Contd.)

| Year | Aman Paddy | Aus Paddy | Boro Paddy | Wheat |
|---|---|---|---|---|
| 1967-68 | 5864000 | 266000 | 89000 | 70000 |
| 1968-69 | 6586000 | 347000 | 186000 | 219000 |
| 1969-70 | 9854082 | 701805 | 584895 | 591231 |
| 1970-71 | 8455439 | 901865 | 1640671 | 714575 |
| 1971-72 | 6483903 | 1041209 | 2933061 | 737155 |
| 1972-73 | 8331757 | 762627 | 1684302 | 590006 |
| 1973-74 | 7640295 | 746994 | 2794210 | 585338 |
| 1974-75 | 8887611 | 861008 | 3258249 | 628750 |
| 1975-76 | 10480468 | 790944 | 3247578 | 850936 |
| 1976-77 | 8648471 | 812886 | 1816358 | 797332 |
| 1978-79 | 12309219 | 1005633 | 4589477 | 592061 |

[Source : Statistical Abstract & Socio-economic Evaluation, Calcutta]

**TABLE 5.11**

**Acreage of Secondary Crops (Area in hectares)**

| Year | Sugarcane | Oilseed | Jute | Potato | Pulses |
|---|---|---|---|---|---|
| 1947-48 | 4171 | 3199 | 2308 | 6500 | |
| 1948-49 | 4900 | 3240 | 4050 | 4400 | |
| 1949-50 | 4860 | 1741 | 4698 | 9200 | |
| 1950-51 | 2916 | 1539 | 6318 | 5300 | |
| 1951-52 | 3645 | 2349 | 14296 | 7400 | |
| 1952-53 | 3766 | 2592 | 10854 | 5500 | |
| 1953-54 | 2227 | 1903 | 4415 | 6300 | |
| 1954-55 | 2754 | 2875 | 5670 | 7700 | |
| 1955-56 | 4090 | 2754 | 8869 | 8000 | |
| 1956-57 | 3523 | 2106 | 10570 | 8300 | |
| 1957-58 | 2794 | 1174 | 8343 | 7600 | |
| 1958-59 | 2100 | 2600 | 9200 | 9100 | |
| 1959-60 | 3300 | 4300 | 7000 | 11000 | |
| 1860-61 | 3700 | 3000 | 6800 | 11299 | 49000 |
| 1961-62 | 3685 | 3037 | 6763 | 9639 | 45100 |
| 1962-63 | 3564 | 4819 | 14539 | 12474 | 30600 |
| 1963-64 | 3888 | 3847 | 14337 | 13041 | 35300 |
| 1964-65 | 4333 | 4374 | 15835 | 13689 | 33900 |
| 1965-66 | 4900 | 3604 | 17091 | 16159 | 31800 |
| 1966-67 | 2794 | 4414 | 9801 | 14013 | 34100 |

Contd...

Table 5.11 (Contd.)

| Year | Sugarcane | Oilseed | Jute | Potato | Pulses |
|---|---|---|---|---|---|
| 1967-68 | 2632 | 2754 | 12555 | 15025 | 25500 |
| 1968-69 | 3280 | 3847 | 16524 | 11745 | 30600 |
| 1969-70 | 3807 | 5062 | 5427 | 9072 | 32400 |
| 1970-71 | 3483 | 4293 | 12838 | 14580 | 28900 |
| 1971-72 | 3523 | 5589 | 9558 | 14053 | 22400 |
| 1972-73 | 3000 | 2800 | 6700 | 14600 | 23900 |
| 1973-74 | 2400 | 5500 | 15400 | 14900 | 26000 |
| 1974-75 | 1700 | 6200 | 12200 | 20300 | 25000 |
| 1975-76 | 2100 | 7900 | 9200 | 22300 | 32600 |
| 1976-77 | 2400 | 8300 | 13100 | 22000 | 22400 |
| 1977-78 | 2000 | 13300 | 15400 | 22900 | 21900 |

[Source : Statistical Abstract
Socio-Economic Evaluation, Calcutta ]

## TABLE 6.1

Production of Paddy in Burdwan (Production in Quintals)

| Name of the P.S. | 1966-67 | 1967-68 | 1968-69 | 1969-70 | 1970-71 | 1971-72 | 1972-73 | 1973-74 | 1974-75 | 1975-76 | 1976-77 | 1977-78 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Salanpur | 8696 | 65707 | 83328 | 189655 | 74554 | 87424 | 71030 | 60483 | 94783 | 21230 | 45130 | 86964 |
| Kulti | 11424 | 92520 | 119863 | 83881 | 14439 | 96505 | 45200 | 65254 | 75886 | 64086 | 13055 | 114790 |
| Hirapur | 13708 | 37164 | 38799 | 15141 | 18374 | 30461 | 24204 | 17378 | 17529 | 21892 | 6802 | 38182 |
| Asansol | 2499 | 19504 | 13822 | 17299 | 16920 | 19674 | 19648 | 14782 | 17852 | 142276 | 5263 | 23728 |
| Barabani | 2332 | 16847 | 19845 | 127868 | 146239 | 153141 | 94855 | 116396 | 136674 | 109695 | 71678 | 178371 |
| Jamuria | 17151 | 49778 | 68567 | 229948 | 179439 | 185051 | 182103 | 130830 | 241105 | 222074 | 98428 | 446257 |
| Raniganj | 8277 | 61578 | 49252 | 47452 | 22113 | 18048 | 13766 | 11030 | 11751 | 20863 | 11380 | 36385 |
| Andal | 5788 | 28804 | 93649 | 92806 | 10577 | 80495 | 51034 | 42181 | 92059 | 178025 | 22173 | 94991 |
| Faridpur | 22093 | 65270 | 54129 | 132783 | 135054 | 130033 | 133375 | 87805 | 129153 | 142276 | 83110 | 140494 |
| Kanksa | 31242 | 123541 | 157800 | 114147 | 229216 | 191460 | 240080 | 264845 | 271954 | 344985 | 169305 | 290740 |
| Ausgram | 691401 | 739222 | 686704 | 799136 | 852128 | 695014 | 898632 | 729622 | 775384 | 1479172 | 695940 | 1077103 |
| Galsi | 528689 | 715550 | 735686 | 869042 | 916048 | 510757 | 997882 | 1036337 | 1362446 | 975757 | 1030133 | 1866370 |
| Khandaghosh | 187017 | 458151 | 355544 | 532141 | 580087 | 357927 | 529385 | 469079 | 639932 | 822948 | 497290 | 586838 |
| Raina | 549298 | 858016 | 648025 | 1147699 | 829292 | 704894 | 980337 | 808345 | 928208 | 1294767 | 935274 | 1349012 |
| Jamalpur | 491740 | 490161 | 574700 | 513184 | 575265 | 468584 | 618072 | 639660 | 857827 | 866281 | 592983 | 856397 |
| Memari | 566843 | 950206 | 1046827 | 1024549 | 1119813 | 701961 | 1610666 | 1561652 | 1571200 | 1371890 | 1413634 | 1642082 |
| Burdwan | 236105 | 252805 | 319440 | 852879 | 1045457 | 535553 | 900848 | 959100 | 1027417 | 786659 | 1073878 | 1242541 |
| Bhatar | 280735 | 406350 | 505496 | 611199 | 569345 | 538275 | 676416 | 573600 | 662192 | 1065388 | 822645 | 1085042 |
| Mongalkote | 257588 | 258572 | 387912 | 419182 | 452362 | 275829 | 369397 | 444244 | 341273 | 667597 | 616696 | 771947 |
| Ketugram | 404054 | 293652 | 476215 | 584703 | 571064 | 388185 | 1023597 | 694045 | 910024 | 627871 | 450538 | 817377 |
| Katwa | 328640 | 367304 | 451685 | 648210 | 835784 | 549941 | 490913 | 604128 | 724478 | 791342 | 428222 | 1335643 |
| Monteswar | 24897 | 74058 | 165877 | 662702 | 622321 | 474672 | 397645 | 783820 | 726775 | 753264 | 711446 | 1125747 |
| Purbasthali | 410200 | 647397 | 383482 | 450781 | 363758 | 442403 | 483791 | 455298 | 670076 | 834835 | 586293 | 715455 |
| Kalna | 246603 | 324639 | 523556 | 621134 | 843400 | 555298 | 567197 | 719321 | 817989 | 901326 | 734764 | 862988 |

TABLE 6.2

Co-efficient of variability of yield rate of Wheat in Burdwan

| Name of the P.S. | 1966-67 | 1967-68 | 1968-69 | 1969-70 | 1970-71 | 1971-72 | 1972-73 | 1973-74 | 1974-75 | 1975-76 | 1976-77 | 1977-78 | C.V. (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Salanpur | 3.73 | 5.59 | 3.35 | 6.12 | 6.75 | 8.28 | - | 3.7 | 5.22 | 5.28 | 4.26 | 3.3 | 29.82 |
| Kulti | 2.24 | 5.59 | - | 8.0 | 5.53 | 6.47 | - | 6.5 | 8.8 | 6.47 | 9.32 | 8.8 | 29.5 |
| Hirapur | 2.61 | 2.98 | - | 4.5 | 4.95 | 8.53 | 6.58 | 6.4 | 6.28 | 8.3 | 5.93 | 4.8 | 32.24 |
| Asansol | 2.61 | 2.24 | 4.47 | 6.9 | 4.75 | 8.39 | - | 7.5 | 9.08 | 8.9 | 5.6 | 5.0 | 38.67 |
| Barabani | 2.98 | 3.35 | 2.98 | 8.95 | 5.83 | 7.36 | - | 10.4 | 8.5 | 2.9 | 4.08 | 5.0 | 45.97 |
| Jamuria | 4.07 | 4.47 | 5.7 | 10.2 | 6.0 | 9.1 | 4.9 | 13.4 | 8.4 | 7.9 | 4.9 | 8.9 | 45.26 |
| Raniganj | 1.49 | 2.98 | 2.98 | 10.35 | 10.6 | 11.45 | 7.41 | 3.0 | 8.5 | 9.16 | 10.0 | 9.76 | 47.65 |
| Andal | 2.98 | 2.24 | 2.98 | 4.92 | 5.51 | 5.12 | 5.74 | 6.6 | 8.49 | 7.68 | 6.23 | 5.25 | 33. |
| Faridpur | 3.35 | 2.98 | 2.98 | 7.3 | 10.34 | 10.9 | 7.32 | 11.3 | 8.5 | 6.98 | 7.62 | 7.86 | 38.25 |
| Kanksa | 4.85 | 4.85 | 6.53 | 5.94 | 11.85 | 6.47 | 7.9 | 9.1 | 5.73 | 10.53 | 3.92 | 9.9 | 33.24 |
| Ausgram | 9.06 | 5.4 | 6.12 | 7.86 | 10.59 | 9.1 | 8.04 | 7.8 | 7.5 | 8.9 | 8.7 | 9.16 | 20.5 |
| Galsi | 5.60 | 5.8 | 6.85 | 7.4 | 11.8 | 9.19 | 9.5 | 7.2 | 8.9 | 9.1 | 8.8 | 9.4 | 24.5 |
| Khandaghosh | 4.47 | 7.46 | 13.06 | 7.28 | 12.83 | 11.63 | 9.86 | 9.80 | 11.6 | 7.36 | 8.5 | 8.83 | 26.3 |
| Raina | 4.1 | 5.7 | 7.8 | 7.5 | 9.5 | 10.9 | 8.7 | 9.2 | 9.1 | 9.8 | 9.4 | 9.1 | 22.6 |
| Jamalpur | 7.09 | 7.46 | 6.72 | 10.4 | 10.65 | 10.49 | 9.3 | 7.0 | 9.5 | 7.42 | 9.4 | 10.4 | 16.9 |
| Memari | 6.15 | 7.27 | 9.05 | 10.9 | 10.09 | 8.5 | 8.0 | 9.45 | 9.26 | 8.56 | 8.9 | 9.6 | 18. |
| Burdwan | 1.86 | 6.72 | 10.07 | 9.74 | 12.5 | 11-77 | 7.8 | 7.8 | 9.21 | 8.2 | 8.92 | 9.31 | 29.85 |
| Bhatar | 6.72 | 5.59 | 11.19 | 9.1 | 11.22 | 11.79 | 6.57 | 8.3 | 6.8 | 10.10 | 8.0 | 9.0 | 22.69 |
| Mongalkote | 3.35 | 5.22 | 5.97 | 7.65 | 11.06 | 11.19 | 7.81 | 8.0 | 9.8 | 7.77 | 7.92 | 9.6 | 27.92 |
| Ketugram | 2.7 | 4.6 | 6.2 | 6.8 | 10.9 | 9.1 | 6.6 | 9.8 | 7. 5 | 7.8 | 9.11 | 6.6 | 30.2 |
| Katwa | 3.89 | 3.0 | 3.8 | 8.4 | 10.8 | 9.6 | 6.98 | 5.5 | 9.6 | 10.1 | 9.08 | 8.4 | 35.9 |
| Monteswar | 3.73 | 5.22 | 8.95 | 7.47 | 12.83 | 12.52 | 11.21 | 7.0 | 8.7 | 7.8 | 9.88 | 8.05 | 30.3 |
| Purbasthali | 6.72 | 5.1 | 5.5 | 8.9 | 11.3 | 10.4 | 11.5 | 8.8 | 8.2 | 8.7 | 9.7 | 7.5 | 24.25 |
| Kalna | 4.47 | 7.46 | 8.9 | 9.9 | 11.5 | 8.1 | 7.5 | 8.1 | 8.1 | 8.9 | 10.8 | 8.2 | 23.9 |

Source : Intensive Agricultural District Programme, Burdwan.

TABLE 6.3

Yield of principal crops in Burdwan

Yield rate in quintal/hectare

| Y e a r | Aman Paddy | Aus Paddy | Boro Paddy | Wheat |
|---|---|---|---|---|
| 1947-48 | 9.8 | 4.74 | 6.88 | 7.28 |
| 1948-49 | 9.33 | 8.56 | 18.41 | 6.51 |
| 1949-50 | 9.67 | 9.35 | 18.51 | 5.75 |
| 1950-51 | 12.09 | 11.53 | 18.41 | 8.07 |
| 1951-52 | 10.71 | 7.48 | 11.03 | 10.96 |
| 1952-53 | 10.81 | 10.64 | 11.03 | 8.17 |
| 1953-54 | 15.85 | 10.24 | 11.97 | 9.06 |
| 1954-55 | 12.98 | 12.76 | 11.5 | 10.17 |
| 1955-56 | 11.55 | 9.55 | 9.97 | 7.18 |
| 1956-57 | 11.7 | 10.71 | 11.55 | 5.92 |
| 1957-58 | 13.11 | 8.22 | 11.03 | 8.17 |
| 1958-59 | 11.80 | 10.86 | 11.05 | 6.66 |
| 1959-60 | 15.33 | 11.75 | 11.03 | 7.65 |
| 1960-61 | 13.97 | 6.17 | 11.0 | 7.6 |
| 1961-62 | 13.35 | 9.4 | 11.97 | 6.49 |
| 1962-63 | 15.97 | 10.19 | 11.9 | 6.88 |
| 1963-64 | 15.18 | 12.09 | 11.5 | 6.29 |
| 1964-65 | 14.81 | 11.82 | 12.0 | 7.35 |
| 1965-66 | 13.82 | 10.59 | 13.9 | 6.79 |
| 1966-67 | 13.85 | 10.81 | 22.2 | 8.81 |
| 1967-68 | 15.40 | 10.86 | 29.48 | 21.0 |
| 1968-69 | 23.18 | 20.27 | 41.03 | 19.33 |
| 1969-70 | 21.65 | 27.85 | 51.43 | 27.18 |
| 1970-71 | 19.01 | 30.27 | 48.24 | 24.98 |
| 1971-72 | 21.20 | 27.13 | 37.7 | 20.24 |
| 1972-73 | 19.85 | 23.45 | 36.29 | 20.0 |
| 1973-74 | 23.06 | 26.91 | 39.58 | 20.98 |
| 1974-75 | 26.91 | 26.8 | 40.07 | 21.43 |
| 1975-76 | 22.98 | 25.62 | 46.04 | 21.7 |
| 1976-77 | 22.9 | 25.62 | 46.03 | 21.7 |
| 1977-78 | 30.86 | 31.35 | 41.75 | 21.48 |

TABLE 6.4

Yield (quintal/hectare) of principal crops in Burdwan

| Name of the P.S. | Paddy | | | Wheat | | |
|---|---|---|---|---|---|---|
| | 1966-67 | 1972-73 | 1977-78 | 1966-67 | 1972-73 | 1977-78 |
| Salanpur | 2.82 | 19.89 | 24.38 | 9.33 | - | 18.2 |
| Kulti | 12.76 | 14.94 | 26.39 | 5.57 | - | 22.23 |
| Hirampur | 5.54 | 17.94 | 30.09 | 6.36 | 16.55 | 10.52 |
| Asansol | 5.22 | 17.16 | 20.72 | 6.71 | - | 12.33 |
| Barabani | 4.86 | 17.86 | 26.45 | 7.44 | - | 12.34 |
| Jamuria | 12.82 | 19.39 | 41.52 | 10.44 | 12.16 | 22.21 |
| Raniganj | 7.36 | 15.09 | 32.51 | 3.70 | 18.36 | 23.80 |
| Andal | 9.16 | 15.74 | 26.53 | 7.36 | 14.36 | 12.94 |
| Faridpur | 5.52 | 9.83 | 20.14 | 8.23 | 18.14 | 19.47 |
| Kanksa | 6.49 | 21.80 | 24.72 | 11.96 | 19.5 | 24.45 |
| Ausgram | 17.07 | 26.6 | 29.7 | 15.09 | 19.05 | 22.62 |
| Galsi | 18.09 | 28.27 | 36.66 | 13.38 | 23.32 | 23.29 |
| Khandaghosh | 16.45 | 29.33 | 32.51 | 11.07 | 24.36 | 21.8 |
| Raina | 18.0 | 24.56 | 33.8 | 9.32 | 21.54 | 23.29 |
| Jamalpur | 16.81 | 27.87 | 31.26 | 15.75 | 22.96 | 25.68 |
| Memari | 18.26 | 31.82 | 34.01 | 13.92 | 21.0 | 20.7~~1~~0 |
| Burdwan | 18.27 | 26.74 | 36.3 | 4.13 | 19.25 | 22.98 |
| Bhatar | 15.39 | 26.68 | 35.67 | 16.62 | 16.21 | 22.22 |
| Mongalkote | 11.21 | 15.86 | 30.39 | 8.27 | 18.73 | 23.7 |
| Ketugram | 15.76 | 17.36 | 31.29 | 6.72 | 16.5 | 16.86 |
| Katwa | 16.57 | 18.47 | 25.07 | 10.13 | 17.25 | 18.14 |
| Monteswar | 5.87 | 14.93 | 35.64 | 9.32 | 27.66 | 19.77 |
| Purbasthali | 12.56 | 24.5 | 30.44 | 16.58 | 25.53 | 19.38 |
| Kalna | 12.33 | 21.56 | 30.88 | 11.05 | 18.56 | 20.31 |

TABLE 6.5

Area under double and triple cropping in Burdwan

| Name of the P.S. | In percentages Double crop | Triple crop |
|---|---|---|
| Salanpur | 10.48 | - |
| Kulti | 3.47 | - |
| Hirapur | 35.64 | - |
| Asansol | 34.5 | - |
| Barabani | 2.67 | - |
| Jamuria | 13.49 | 0.23 |
| Raniganj | 22.46 | - |
| Andal | 5.56 | - |
| Faridpur | 48.25 | 6.2 |
| Kanksa | 27.38 | 6.07 |
| Ausgram | 13.82 | 0.46 |
| Galsi | 69.39 | 1.32 |
| Khandaghosh | 41.34 | 20.67 |
| Raina | 17.0 | 1.61 |
| Jamalpur | 76.17 | 3.58 |
| Memari | 80.34 | 12.0 |
| Burdwan | 67.12 | - |
| Bhatar | 37.0 | 10.81 |
| Mongalkote | 16.52 | 7.64 |
| Ketugram | 23.09 | 1.65 |
| Katwa | 39.25 | 12.32 |
| Monteswar | 22.54 | 0.79 |
| Purbasthali | 47.27 | 4.24 |
| Kalna | 40.73 | 3.73 |

TABLE 6.6

Crop Area (in hectare) irrigated

| | Aman Paddy | Aus Paddy | Jute | Boro Paddy | Wheat | Sugar-cane | Potato | Onion | Pulses | Veget-ables | Oil seeds |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1966-67 | 204282 | 157 | - | 99 | 521 | 163 | 5753 | 538 | - | 702 | - |
| 1967-68 | 205997 | - | 210 | 680 | 877 | 326 | 6480 | 547 | 0.81 | 723 | 8.5 |
| 1968-69 | 209622 | 109 | - | 2983 | 1779 | 345 | 6337 | 637 | 3.64 | 696 | 6.1 |
| 1969-70 | 215775 | - | 120 | 4416 | 1809 | 426 | 6426 | 547 | - | 599 | 4.1 |
| 1970-71 | 218437 | - | 82 | 13493 | 2049 | 430 | 6413 | 330 | - | 451 | 5.7 |
| 1971-72 | 219447 | 90 | 36 | 36786 | 2471 | 336 | 6420 | 241 | 3.64 | 592 | 4.4 |
| 1972-73 | 220593 | 91 | 36 | 23346 | 2014 | 211 | 6173 | 134 | 189 | 374 | 0.81 |
| 1973-74 | 221986 | 89 | 31 | 38092 | 3144 | 357 | 6496 | 210 | 16 | 302 | 97.2 |
| 1974-75 | 222581 | 90 | 31 | 50748 | 3692 | 333 | 6896 | 174 | 103 | 230 | 73.3 |
| 1975-76 | 224423 | 89 | 32 | 52512 | 3845 | 219 | 6820 | 144 | 81 | 315 | 45.76 |
| 1976-77 | 227418 | 3387 | 32 | 11871 | 4520 | 174 | 6879 | 107 | 13 | 214 | 132. 43 |
| 1977-78 | 232428 | 3365 | 30 | 31679 | 4598 | 160 | 6969 | 148 | 205 | 271 | 147.01 |

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## TABLE 6.7

Percentage of acreage of crops in Burdwan

| | Paddy | Wheat | Pulses | Potato | Sugar-cane | Jute | Others |
|---|---|---|---|---|---|---|---|
| Salanpur | 82 | 1.59 | 2.5 | 1.59 | - | - | 12.32 |
| Kulti | 88 | 2.0 | 2.32 | - | - | - | 7.68 |
| Hirapur | 85 | 3.7 | 2.3 | - | - | - | 9.0 |
| Asansol | 79 | - | 4.0 | - | - | - | 17.0 |
| Barabani | 90 | - | 1.9 | - | - | - | 8.1 |
| Jamuria | 92 | - | 3.5 | - | 1.94 | - | 2.56 |
| Raniganj | 94 | 2.9 | - | - | - | - | 3.1 |
| Andal | 88 | 2.92 | 0.5 | 1.36 | 0.5 | - | 6.72 |
| Faridpur | 90 | 1.0 | 2.36 | - | 0.9 | - | 5.74 |
| Kanksa | 90 | 2.0 | 1.0 | - | 1.94 | - | 5.06 |
| Ausgram | 92 | - | 2.78 | - | - | - | 5.22 |
| Galsi | 90 | 2.92 | 2.56 | - | - | - | 4.52 |
| Khandaghosh | 86 | 2.0 | - | - | 4.13 | - | 7.87 |
| Raina | 94 | 2.05 | - | 1.76 | - | - | 2.19 |
| Jamalpur | 70 | 3.63 | 2.7 | 9.0 | - | 7.26 | 7.41 |
| Memari | 84 | 2.17 | - | 9.3 | - | - | 4.53 |
| Burdwan | 90 | 1.0 | - | 1.97 | - | - | 7.03 |
| Bhatar | 95 | 1.95 | - | 2.05 | -q | - | 1.0 |
| Mongalkote | 82 | - | 4.88 | 3.41 | 1.73 | - | 7.98 |
| Ketugram | 76 | 2.83 | 5.4 | 1.9 | - | 2.66 | 11.21 |
| Katwa | 74 | 1.5 | 9.1 | 2.66 | 1.6 | 5.03 | 6.11 |
| Monteswar | 97 | 0.5 | 1.0 | 1.0 | - | - | 0.5 |
| Purbasthali | 73 | 3.1 | 6.5 | - | - | 11.64 | 5.76 |
| Kalna | 72 | 2.89 | 1.92 | 5.5 | - | 4.1 | 13.59 |

## TABLE 6.8

Acreage of Secondary Crops in Burdwan during 1976-77

(Area in hectare)

| | Sugar-cane | Potato | Jute | Mesta | Barley | Oil Seed | Kharif Pulses | Rabi pulses |
|---|---|---|---|---|---|---|---|---|
| Salanpur | 11.34 | 3.25 | - | - | - | 1.62 | 24.3 | 57.0 |
| Kulti | 12.15 | 2.04 | - | - | - | 1.01 | 36.45 | 1.2 |
| Hirapur | 5.67 | 2.83 | - | - | - | 17.21 | 21.06 | 49.0 |
| Asansol | 1.62 | 2.02 | - | - | - | 8.6 | 16.2 | 69.0 |
| Barabani | 16.2 | 3.24 | - | - | - | 0.81 | 60.75 | 238.0 |
| Jamuria | 24.3 | 12.15 | - | - | - | 29.56 | 42.52 | 302.0 |
| Raniganj | 9.31 | 4.05 | - | - | - | 4.86 | 25.51 | 6.0 |
| Andal | 18.42 | 50.62 | - | - | - | 15.79 | 20.25 | 30.0 |
| Faridpur | 36.45 | 83.02 | - | - | - | 25.51 | 10.53 | 136.0 |
| Kanksa | 141.75 | 405.0 | 32.4 | 60.75 | 1.21 | 138.1 | 59.13 | 77.0 |
| Ausgram | 328.86 | 791.77 | 24.30 | 53.05 | 10.12 | 221.53 | 42.0 | 603.0 |
| Galsi | 93.15 | 526.5 | 52.65 | 68.85 | - | 585.22 | 47.79 | 341.0 |
| Khandaghosh | 81.0 | 1093.5 | 190.35 | 151.87 | 4.05 | 384.75 | 107.32 | 304.0 |

Contd...

TABLE 6.8 (Contd.).

| | Sugarcane | Potato | Jute | Mesta | Barley | Oilseed | Kharif Pulses | Rabi pulses |
|---|---|---|---|---|---|---|---|---|
| Raina | 62.17 | 1204.87 | 462.10 | 16.19 | - | 945.67 | 64.8 | 307.0 |
| Jamalpur | 25.51 | 4521.82 | 1006.42 | 4.05 | 7.29 | 2122.2 | 87.88 | 611.0 |
| Memari | 63.58 | 4558.27 | 58.52 | - | - | 510.3 | 46.57 | 203.0 |
| Burdwan | 39.28 | 587.25 | 39.69 | 20.25 | 6.07 | 220.72 | 9.31 | 262.0 |
| Bhatar | 141.75 | 607.5 | 10.12 | 6.75 | 8.1 | 305.77 | 174.15 | 295.0 |
| Mongalkote | 281.47 | 1138.45 | 48.6 | - | - | 691.74 | 52.65 | 1534.0 |
| Ketugram | 451.98 | 396.9 | 233.8 | 22.68 | 360.45 | 356.0 | 11.34 | 1132.0 |
| Katwa | 243.0 | 1194.75 | 880.87 | 118.7 | 2.03 | 528.52 | 165.24 | 1258.0 |
| Monteswar | 2.43 | 607.5 | 30.37 | 1.21 | 2.02 | 37.07 | 60.75 | 17.0 |
| Purbasthali | 194.4 | 972.0 | 3240.0 | 156.33 | 25.51 | 1571.4 | 794.61 | 3426.0 |
| Kalna | 90.72 | 3275.23 | 1890.54 | 14.17 | 8.1 | 495.72 | 76.97 | 1070.0 |

Source : IADP Office, Burdwan.

TABLE 6.9

Index Number of Agricultural Productivity of Burdwan District

Base Crop Year 1956-57 = 100

| | Paddy | Wheat | Pulses | Oilseeds | Jute | Potato | Sugarcane |
|---|---|---|---|---|---|---|---|
| 1960-61 | 129.7 | 200.5 | 132.4 | 142.2 | 130.8 | 252.0 | 95.1 |
| 1961-62 | 116.6 | 197.6 | 124.7 | 124.5 | 136.8 | 282.9 | 80.7 |
| 1962-63 | 113.2 | 170.6 | 104.1 | 148.4 | 174.9 | 312.4 | 97.8 |
| 1963-64 | 134.3 | 187.5 | 110.8 | 122.7 | 161.8 | 192.7 | 105.6 |
| 1964-65 | 128.7 | 166.5 | 108.1 | 131.1 | 214.6 | 281.3 | 143.1 |
| 1965-66 | 125.4 | 201.2 | 139.0 | 172.4 | 98.7 | 233.9 | 101.3 |
| 1966-67 | 117.3 | 182.8 | 103.0 | 127.3 | 122.5 | 206.3 | 88.4 |
| 1967-68 | 117.9 | 231.0 | 109.8 | 127.2 | 178.4 | 202.0 | 100.3 |
| 1968-69 | 131.0 | 585.3 | 118.5 | 176.1 | 109.6 | 306.5 | 123.3 |
| 1969-70 | 129.4 | 606.4 | 107.9 | 166.0 | 197.5 | 248.2 | 131.6 |
| 1970-71 | 135.7 | 717.5 | 133.2 | 139.3 | 175.4 | 345.8 | 104.9 |
| 1971-72 | 128.0 | 661.0 | 122.2 | 144.6 | 189.8 | 290.8 | 96.7 |
| 1972-73 | 123.9 | 533.6 | 124.1 | 173.3 | 187.3 | 297.9 | 109.7 |
| 1973-74 | 123.5 | 520.9 | 113.4 | 149.7 | 171.0 | 256.7 | 105.4 |
| 1974-75 | 137.4 | 553.7 | 128.9 | 126.0 | 189.0 | 397.0 | 114.0 |

TABLE 7.0

Crop yield index in B u r d w a n

| | $\Sigma(\frac{A_1}{B_1} \times 100)(\frac{C_1}{D_1} \times 100)$ | $\Sigma(\frac{A_1}{B_1} \times 100)$ | $\frac{\Sigma(\frac{A_1}{B_1} \times 100)(\frac{C_1}{D_1} \times 100)}{\Sigma(\frac{A_1}{B_1} \times 100)}$ |
|---|---|---|---|
| Salanpur | 298.49 | 3.19 | 93.42 |
| Kulti | 270.32 | 3.16 | 85.54 |
| Hirapur | 204.66 | 2.41 | 84.85 |
| Asansol | 170.09 | 2.02 | 82.20 |
| Barabani | 430.07 | 6.03 | 71.32 |
| Jamuria | 806.37 | 9.34 | 86.33 |
| Raniganj | 216.07 | 2.48 | 87.12 |
| Andal | 297.34 | 3.47 | 85.64 |
| Faridpur | 577.20 | 6.21 | 92.95 |
| Kanksa | 2761.39 | 29.92 | 92.29 |
| Ausgram | 5763.33 | 54.93 | 104.92 |
| Galsi | 6333.67 | 53.54 | 118.74 |
| Khandaghosh | 6855.77 | 63.1 | 108.65 |
| Raina | 6604.58 | 52.49 | 125.83 |
| Jamalpur | 9982.01 | 95.89 | 104.10 |
| Memari | 9801.01 | 84.98 | 115.33 |
| Burdwan | 4339.40 | 41.61 | 104.29 |
| Bhatar | 5756.68 | 54.81 | 105.03 |
| Mongalkote | 6692.73 | 63.57 | 105.28 |
| Ketugram | 19863.22 | 145.99 | 136.06 |
| Katwa | 9726.07 | 94.08 | 103.38 |
| Monteswar | 4686.66 | 40.3 | 116.29 |
| Purbasthali | 21147.27 | 220.11 | 96.08 |
| Kalna | 11221.46 | 96.92 | 115.78 |

Table 7.1

Intensity of Irrigation in Burdwan

| | Net irrigated area (I) | Net sown area (N) | Intensity of irrigation (in percentages) $[\frac{I}{N} \times 100]$ |
|---|---|---|---|
| Chittaranjan | 0 | 30 | 0 |
| Salanpur | 0 | 101 | 0 |
| Kulti | 11 | 138 | 7.97 |
| Hirapur | 16 | 80 | 20.0 |
| Asansol | 0 | 140 | 0 |
| Barabani | 35 | 200 | 17.5 |
| Jamuria | 0 | 165 | 0 |
| Ranigunj | 6 | 142 | 4.22 |
| Andal | 3 | 134 | 2.24 |
| Faridpur | 34 | 170 | 20.0 |
| Durgapur | 0 | 14 | 0 |
| Kanksa | 25 | 109 | 22.93 |
| Budbud | 49 | 168 | 29.17 |
| Ausgram | 135 | 250 | 54.0 |
| Galsi | 246 | 295 | 83.39 |
| Khandaghosh | 203 | 252 | 80.55 |
| Raina | 183 | 291 | 62.89 |
| Jamalpur | 134 | 263 | 50.95 |
| Memari | 234 | 295 | 79.05 |
| Burdwan | 204 | 253 | 80.63 |
| Bhatar | 228 | 263 | 86.69 |
| Mangalkote | 175 | 287 | 60.97 |
| Ketugram | 148 | 294 | 50.34 |
| Katwa | 117 | 267 | 43.82 |
| Monteswar | 187 | 284 | 65.84 |
| Purbasthali | 48 | 247 | 19.43 |
| Kalna | 114 | 273 | 41.76 |

Source : 1971 Census, Burdwan.

**TABLE 7.2**

**Relationship between Canal irrigated area and cultivated area (Area in hectare)**

| Y e a r | Canal irrigated area | Cultivated area |
|---|---|---|
| 1947-48 | 77271 | 455385 |
| 1948-49 | 77372 | 460525 |
| 1949-50 | 79414 | 478102 |
| 1950-51 | 78956 | 470853 |
| 1951-52 | 99714 | 449388 |
| 1952-53 | 103331 | 480127 |
| 1953-54 | 102384 | 489645 |
| 1954-55 | 101533 | 481383 |
| 1955-56 | 109998 | 486324 |
| 1956-57 | 113076 | 484258 |
| 1957-58 | 142641 | 479000 |
| 1958-59 | 170302 | 471600 |
| 1959-60 | 190000 | 485037 |
| 1960-61 | 204800 | 498474 |
| 1961-62 | 207900 | 497745 |
| 1962-63 | 217500 | 495477 |
| 1963-64 | 222600 | 489969 |
| 1964-65 | 236100 | 504225 |
| 1965-66 | 235900 | 492115 |
| 1966-67 | 238800 | 490900 |
| 1967-68 | 242400 | 500377 |
| 1968-69 | 242635 | 556591 |
| 1969-70 | 240700 | 568863 |
| 1970-71 | 257400 | 579077 |
| 1971-72 | 274362 | 579915 |
| 1972-73 | 268900 | 554526 |
| 1973-74 | 286600 | 596087 |
| 1974-75 | 300696 | 604669 |
| 1975-76 | 304271 | 613720 |
| 1976-77 | 319747 | 564606 |
| 1977-78 | 298900 | 596780 |

TABLE 7.3

| Name of the P.S. | Irrigated area (in hectare) | | Yield of crops (Qtl/Hect) | | | |
|---|---|---|---|---|---|---|
| | Canal | Total | Aus | Aman | Boro | Wheat |
| Salanpur | - | - | 24.6 | 24.08 | 20.68 | 18.67 |
| Kulti | - | 254.0 | 8.67 | 24.25 | 16.17 | 18.17 |
| Hirapur | | 276.2 | 18.25 | 18.24 | 13.9 | 20.52 |
| Asansol | | 19.4 | - | 17.17 | 20.5 | 18.5 |
| Barabani | | 1495.3 | 18.05 | 20.46 | 18.19 | 17.19 |
| Jamuria | | - | 17.88 | 16.87 | 21.5 | 17.4 |
| Raniganj | | 135.3 | - | 15.81 | 12.8 | 14.8 |
| Andal | | 101.9 | - | 20.45 | 27.32 | 21.6 |
| Faridpur | | 2026.4 | 21.28 | 20.89 | 26.94 | 24.94 |
| Kanksa | 750.0 | 1837.1 | 37.81 | 18.14 | 16.0 | 18.0 |
| Ausgram | 12222.8 | 18994.6 | 21.12 | 19.13 | 23.32 | 25.32 |
| Galsi | 25671.9 | 26880.4 | 19.86 | 16.96 | 23.0 | 26.0 |
| Khandaghosh | 13679.3 | 14656.1 | 27.38 | 17.48 | 28.71 | 23.71 |
| Raina | 24408.5 | 24408.5 | 30.59 | 17.65 | 26.61 | 28.94 |
| Jamalpur | 9649.9 | 9649.9 | 31.46 | 21.5 | 25.89 | 26.9 |
| Memari | 25634.1 | 27773.6 | 30.08 | 17.13 | 24.6 | 28.6 |
| Burdwan | 20614.5 | 23146.2 | 35.29 | 14.87 | 28.08 | 27.13 |
| Bhatar | 25395.1 | 26568.7 | 43.86 | 18.82 | 29.14 | 27.14 |
| Mongalkote | 16739.5 | 17756.4 | 23.18 | 12.06 | 27.63 | 26.63 |
| Ketugram | 13045.0 | 14296.0 | 20.75 | 11.14 | 19.19 | 22.55 |
| Katwa | 7463.7 | 10872.5 | 27.62 | 36.26 | 23.29 | 26.29 |
| Mentesvar | 15815.6 | 15957.3 | 28.34 | 17.30 | 30.94 | 19.56 |
| Purbasthali | - | 4482.5 | 34.86 | 15.91 | 17.01 | 24.95 |
| Kalna | 6494.2 | 10734.2 | 37.96 | 40.25 | 21.24 | 24.24 |

**TABLE 7.4**

| Year | Consumption of fertiliser in quintal | | | | Yield of crop (Qtl/Hect.) | |
|---|---|---|---|---|---|---|
| | Nitrogenous | Phosphotic | Potassic | Total (N.P.K.) | Paddy | Wheat |
| 1961-62 | 7720 | 2130 | 2200 | 12050 | 11.6 | 6.5 |
| 1962-63 | 10020 | 6660 | 6800 | 23480 | 12.7 | 6.9 |
| 1963-64 | 17280 | 8550 | 7300 | 33130 | 12.6 | 6.3 |
| 1964-65 | 18360 | 10900 | 12300 | 41560 | 12.8 | 7.3 |
| 1965-66 | 23447 | 12413 | 15610 | 51470 | 12.7 | 6.8 |
| 1966-67 | 17052 | 8241 | 8860 | 34153 | 15.6 | 8.8 |
| 1967-68 | 22337 | 6040 | 10440 | 38817 | 18.5 | 21.0 |
| 1968-69 | 34100 | 14400 | 34000 | 82500 | 28.1 | 19.3 |
| 1969-70 | 36553 | 11289 | 29830 | 77672 | 33.6 | 27.2 |
| 1970-71 | 45545 | 21530 | 27940 | 95015 | 32.5 | 24.9 |
| 1971-72 | 106280 | 28500 | 34770 | 169550 | 28.9 | 20.2 |
| 1972-73 | 112540 | 36040 | 33720 | 182300 | 26.5 | 20.8 |
| 1973-74 | 152490 | 66650 | 44620 | 263760 | 29.8 | 20.9 |
| 1974-75 | 156190 | 68440 | 51790 | 276420 | 31.3 | 21.4 |
| 1975-76 | 173400 | 62970 | 34600 | 270970 | 31.5 | 21.7 |
| 1976-77 | 238400 | 77260 | 32990 | 348650 | 31.5 | 21.7 |
| 1977-78 | 271623 | 80888 | 32346 | 384857 | 34.6 | 21.5 |

Source : IADP Office, Burdwan.

TABLE 7.5

| Year | Consumption of Pesticides (in Quintal) | Production of Crop (in quintal) | |
|---|---|---|---|
| | | Paddy | Wheat |
| 1961-62 | 1200 | 6117000 | 18000 |
| 1962-63 | 1400 | 5932000 | 22000 |
| 1963-64 | 5400 | 6587000 | 31000 |
| 1964-65 | 3700 | 6832000 | 24000 |
| 1965-66 | 1800 | 6469000 | 28000 |
| 1966-67 | 4500 | 5880000 | 33000 |
| 1967-68 | 3900 | 6219000 | 70000 |
| 1968-69 | 4800 | 7119000 | 219000 |
| 1969-70 | 3900 | 7375000 | 391231 |
| 1970-71 | 5800 | 7355000 | 714575 |
| 1971-72 | 6500 | 7537000 | 737155 |
| 1972-73 | 6600 | 10778686 | 590006 |
| 1973-74 | 6500 | 11181499 | 585338 |
| 1974-75 | 8600 | 13006868 | 628750 |
| 1975-76 | 8300 | 14518990 | 850936 |
| 1976-77 | 19500 | 11277715 | 797332 |

TABLE 7.6

Acreage and Production of HYV Paddy and Wheat

| | HYV Paddy | | HYV Wheat | |
|---|---|---|---|---|
| | Area (Hect.) | Production (Qtl.) | Area (Hect.) | Production (Qtl.) |
| 1966-67 | 8100 | 239922 | 1367 | 30388 |
| 1967-68 | 27551 | 919652 | 4738 | 161423 |
| 1968-69 | 40905 | 1297506 | 9396 | 278830 |
| 1969-70 | 43966 | 1432851 | 13901 | 348730 |
| 1970-71 | 81879 | 3640170 | 24300 | 685660 |
| 1971-72 | 117995 | 4987220 | 27000 | 699650 |
| 1972-73 | 80878 | 3154750 | 28028 | 574890 |
| 1973-74 | 136956 | 4737197 | 289677 | 585338 |
| 1974-75 | 166615 | 6088399 | 29570 | 628750 |
| 1975-76 | 199948 | 7607088 | 38880 | 850936 |
| 1976-77 | 184037 | 6398184 | 36722 | 797333 |
| 1977-78 | 230875 | 9243558 | 27561 | 592061 |